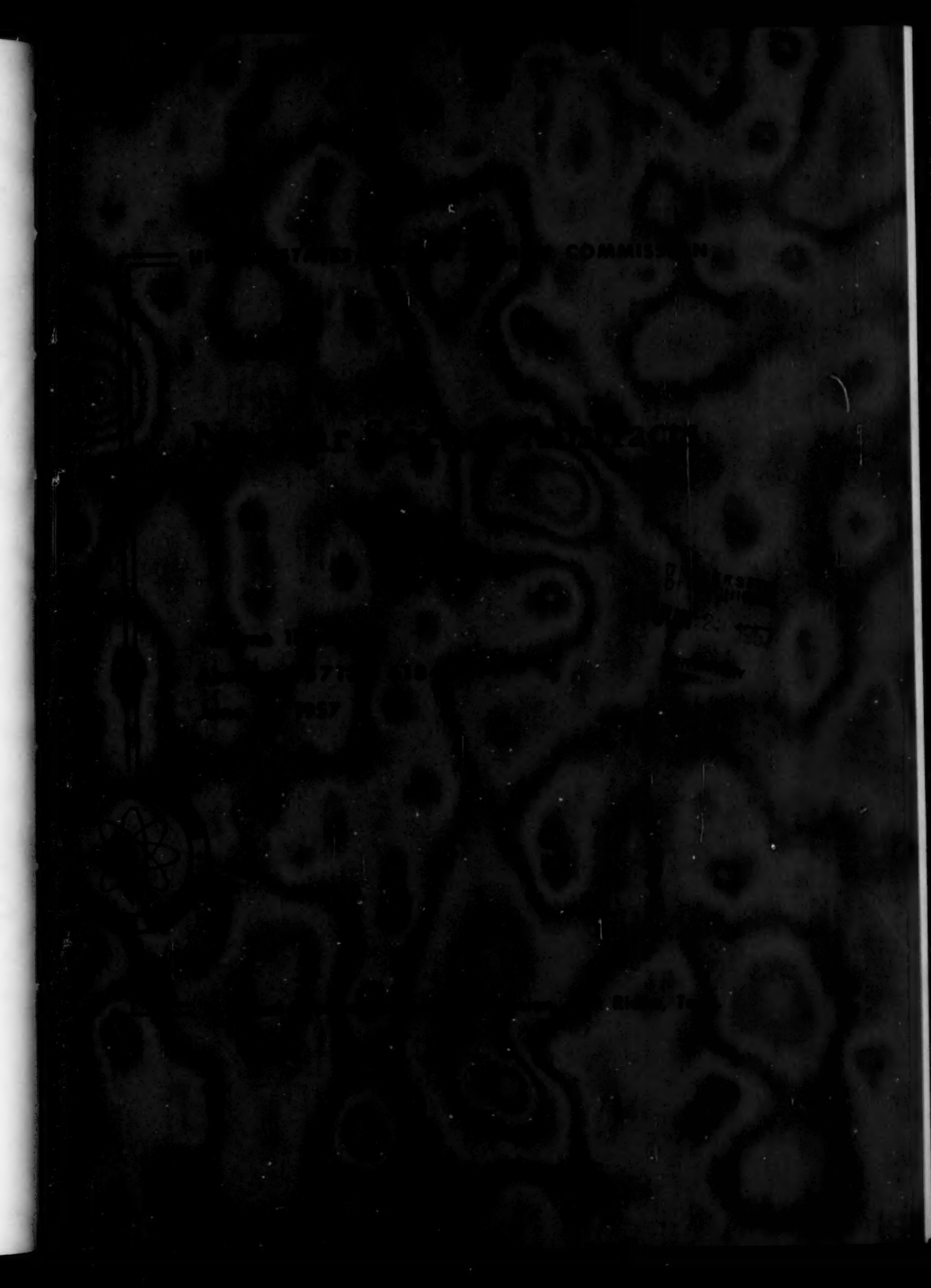

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NUCLEAR SCIENCE ABSTRACTS

Volume 11 June 15, 1957 No. 11

GENERAL

ATOMIC POWER

5712
STATE ACTIVITIES IN ATOMIC ENERGY, THIRD EDITION, FEBRUARY 1957. Saul J. Harris, ed. New York, Atomic Industrial Forum, Inc., 1957. 45p. $0.50.

A summary of the activities of the states to foster and control industrial utilization and development of atomic energy is presented. (auth)

BIOLOGY AND MEDICINE

5713
ENDOCRINE INFLUENCES UPON THE UPTAKE OF COLLOIDAL THORIUM BY RETICULO-ENDOTHELIAL ORGANS. Sherwood M. Reichard, Abraham Edelmann, and Albert S. Gordon (New York Univ., N. Y. and Brookhaven National Lab., Upton, N. Y.). Res Bull, 2, 34-9(1956).

AEROSOLS

5714 DP-188
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
A CONTINUOUS MONITOR FOR AIRBORNE PLUTONIUM. Dowdey C. Collins. Nov. 1956. 16p. Contract AT(07-2)-1. $0.20(OTS).

A continuous monitor has been developed that can detect one MPC (maximum permissible concentration) of Pu in air within ten minutes. Application details are described to assist other groups in adapting the equipment to their needs. (auth)

RADIATION EFFECTS

5715 AEC-tr-2860
EFFECT OF RADIOACTIVITY UPON EXPERIMENTAL POLIOMYELITIS. G. Comba Ezquerra. Translated from Bol. radiactividad (Madrid) 24, 18-33(1951). 16p.

5716
FURTHER STUDIES ON THE REVERSAL IN THE SEEDLING HEIGHT DOSE CURVE AT VERY HIGH LEVELS OF IONIZING RADIATIONS. Drew Schwartz and Ciella E. Bay (Oak Ridge National Lab., Tenn.). Am. Naturalist 40, 232-7 (1956) Sept.–Oct.

5717
β-GLUCURONIDASE ACTIVITY IN LYMPHATIC TISSUES OF THE RAT AFTER X-RAY IRRADIATION OF THE WHOLE BODY. C. Pellegrino and G. Villani (Univ. of Pisa, Italy). Biochem. J. (London) 65, 599-603(1957) March.

5718
EFFECTS OF IONIZING RADIATION ON THE FUNCTIONAL AND MORPHOLOGICAL ALTERATION IN THE ENCEPHALON. K. A. Kyandaryan et al. (Armenian Ministry of Health, Research Inst. of Roentgenology and Oncolody). Doklady Akad. Nauk S.S.S.R. 112, 249-53(1957) Jan. 11. (In Russian)

5719
DIFFERENCES IN RESPONSE OF IRRADIATED EGGS AND SPERMATOZOA OF HABROBRACON TO ANOXIA. Anna R. Whiting and W. E. Murphy (Oak Ridge National Lab., Tenn. and Univ. of Pennsylvania, Philadelphia). Genetics 54, 297-303(1956) May.

5720
AGGLUTININ PRODUCTION IN NORMAL, SUBLETHALLY IRRADIATED, AND LETHALLY IRRADIATED MICE TREATED WITH MOUSE BONE MORROW. Takashi Makinodan, Nazareth Gengozian, and Charles C. Congdon (Oak Ridge National Lab., Tenn.). J. Immunol. 77, 250-6 (1956) Oct.

5721
SOME RESULTS AND IMMEDIATE PROBLEMS IN MEDICAL RADIOLOGY. A. I. Burnazyan. Med. Radiol. 2, 3-10, (1957) Jan.-Feb. (In Russian)

5722
DELAYED PATHOLOGICAL EFFECTS INDUCED BY IONIZING RADIATION. D. I. Zakutinskii. Med. Radiol. 2, 22-8(1957) Jan.-Feb. (In Russian)

5723
ON THE TOXICOLOGY OF RADIOACTIVE MATERIALS. V. A. Sanotskiĭ. Med. Radiol. 2, 28-35(1957) Jan.-Feb. (In Russian)

5724
BLOOD PRESSURE REACTIONS TO IRRADIATION. Yu G. Grigor'ev. Med. Radiol. 2, 47-54(1957) Jan.-Feb. (In Russian)

5725
PATHOMORPHOLOGICAL CHANGES IN ANIMALS POISONED BY RADON INHALATION. A. A. Pinus. Med. Radiol. 2, 55-63(1957) Jan.-Feb. (In Russian)

5726
EFFECTS OF RADIATION SICKNESS ON INTESTINES AFTER TRAUMA. S. P. Mokrovskaya (Kirov State Inst. of Physician Training and Clinic of Medical Radiology). Med. Radiol. 2, 64-70(1957) Jan.-Feb. (In Russian)

5727
HISTOLOGICAL AND HISTOCHEMICAL CHANGES IN GAMMA-IRRADIATED LIMA BEANS, PHASEOLUS LUNATUS. D. K. Salunkhe (Utah State Agricultural Coll., Logan). Nature 179, 585-6(1957) March 16.

5728
THE INFLUENCE OF STRAIN ON ACUTE X-RAY LETHALITY IN THE MOUSE. II. RECOVERY RATE STUDIES. Henry I. Kohn and Robert F. Kallman (Univ. of California School of Medicine, San Francisco). Radiation Research 6, 329-38(1957) Mar.

5729
TUMOR INDUCTION IN RATS BY SINGLE TOTAL-BODY X-IRRADIATION. R. T. Binhammer, J. C. Finerty, M. Schneider, and A. W. B. Cunningham (Univ. of Texas Medical Branch, Galveston). Radiation Research 6, 339-48 (1957) Mar.

5730
A SUBSTANCE OBSERVED WITHIN THE VASCULAR SYSTEM OF DOGS RECEIVING LETHAL EXPOSURES OF WHOLE-BODY X-IRRADIATION. A. C. Andersen (Univ. of California, Davis). Radiation Research 6, 361-70(1957) Mar.

RADIATION HAZARDS AND PROTECTION

5731 KAPL-1699
Knolls Atomic Power Lab., Schenectady, N. Y.
HEALTH PHYSICS REPORT FOR OCTOBER, NOVEMBER, AND DECEMBER 1956. 36p. Contract W-31-109-eng-52. $0.30(OTS).

Personnel, in-plant, and environmental radiation monitoring procedures engaged in during the period are summarized. (For preceding period see KAPL-1689.) (C.H.)

5732 USNRDL-TR-130
Naval Radiological Defense Lab., San Francisco.
RELATIVE DECONTAMINATION OF CLEAN AND ARTIFICIALLY SOILED NAVY GRAY PAINT SURFACES. J. L. Mackin. Jan. 22, 1957. 26p. Project NS 086-001.

Decontamination experiments have been carried out with both clean and artificially soiled Navy gray paint surfaces. Samples were contaminated with two simulants representing the contaminants expected from a nuclear detonation in deep sea water and in shallow water. Nb^{95}, Sr^{89}, Y^{91}, Ce^{144}, and I^{131} were used individually as radioactive tracers for the contaminants, and decontamination was carried out with stirred solutions of 5 reagents in both fresh and synthetic sea water. A total of 1080 samples was used in the experiment. In most cases it was more difficult to decontaminate soiled surfaces than similar clean surfaces, and wetting characteristics indicated a higher susceptibility to contamination for the soiled samples. The behavior upon initial contamination of one isotope, I^{131}, was markedly affected by the presence of a soil film. (auth)

5733 WADC-TR-56-433
Tracerlab, Inc., Boston.
NEUTRON INDUCED RADIOACTIVITIES IN IF-6 IN-FLIGHT FOOD PACKETS. Final Report [for] November 1955 to June 1956. Robert P. Epple. 22p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: ISOTOPIC TRACER APPLICATIONS. Contract AF33(616)-2616. (AD-110733).

A study has been made of the radioactivities induced by neutron irradiation of IF-6 In-Flight food packets. The results show that an integrated exposure of 4×10^{14} nvt was produced. Na^{24} and K^{42} were produced in amounts which are nearly 1000 times the accepted tolerances for these isotopes in the human body. (auth)

5734
SPREAD OF PARTICULATE CONTAMINATION FROM STACKS. William B. Harris. Arch. Ind. Health 15, 274-83 (1957) Apr.

5735
AEROSOL DEPOSITION IN THE HUMAN RESPIRATORY TRACT. I. EXPERIMENTAL PROCEDURES AND TOTAL DEPOSITION. Bernard Altshuler, Leonard Yarmus, and Norton Nelson (New York Univ.). Arch. Ind. Health 15, 293-303(1957) Apr.

5736
THE INFLUENCE OF CHEMICAL PRE- AND POSTTREATMENTS ON RADIOSENSITIVITY OF BACTERIA, AND THEIR SIGNIFICANCE FOR HIGHER ORGANISMS. Alexander Hollaender and George E. Stapleton (Oak Ridge National Lab., Tenn.). Ciba Foundation Symposium on Ionizing Radiations and Cell Metabolism, 120-35(1956).

5737
EFFECTS OF X RADIATION UPON THE CELLULAR COMPOSITION OF BLOOD IN MICE DURING THE APPLICATION OF PROTECTIVE AGENTS. Z. N. Fadeeva (Severtsov Inst. of Animal Morphology). Deklady Akad. Nauk S.S.S.R. 111, 1007-10(1956) Dec. 11. (In Russian)

Cytological changes are described which were observed in mice irradiated in an increased CO_2 atmosphere and in mice given injections of bone marrow emulsion before irradiation. The number of damaged red and white cells in the blood of animals treated by the protective agents was considerably smaller than in untreated control animals. (R.V.J.)

5738
SANITARY PROBLEMS IN RADIOLOGY. A. A. Letavet. Med. Radiol. 2, 11-22(1957) Jan.-Feb. (In Russian)

5739
RECOVERY OF LETHALLY IRRADIATED MICE BY TREATMENT WITH BONE MARROW CELLS MAINTAINED IN VITRO. Daniel Billen (Oak Ridge National Lab., Tenn.). Nature 179, 574-5(1957) March 16.

5740
SURVIVAL STUDIES ON X-IRRADIATED MICE MEDICATED WITH SPLEEN-PREPARATIONS. Anna Goldfeder and Grace E. Clarke (New York Univ.). Radiation Research 6, 318-28(1957) Mar.

5741
THE NATURE OF BIOLOGICAL RADIATION EFFECT FOLLOWING APPLICATION OF PROTECTIVE MATERIAL AFTER RADIATION EXPOSURE. Matthias Krahe, Hans A. Kunkel, and Hans-Joachim Schmermund. Strahlentherapie 102, 288-90(1957) Feb. (In German)

Forty-one hours after a roentgen irradiation with 3000 r, dry seeds of vicia faba were put into a nutrient bouillon containing cysteine. The rate of mitosis fully corresponded to normal values, whereas the mitosis rate of seeds equally treated but without addition of cysteine was diminished by 50% compared to non-irradiated control seeds. By adding cysteamine after the irradiation a protective effect of 100% could be reached. (auth)

5742
INVESTIGATION OF A BIOLOGICAL PROTECTIVE SCREEN. PART XIX. FURTHER RESEARCH ON SENSITIVITY TO RADIATION AND CYSTEAMINE PROTECTION OF MALE MICE AFTER GONADECTOMY. Hanns Langendorff, Alexander Catsch, and Ruprecht Koch. Strahlentherapie 102, 291-7(1957) Feb. (In German)

5743
THE INFLUENCE ON SURVIVAL RATE OF X-IRRADIATED RATS AND MICE OF LIVER AND SPLEEN AUTOLYSATES, SPLEEN HOMOGENATES, AND SPLEEN IMPLANTATION. Hanns Langendorff, Ruprecht Koch, Alexander Catsch, and Ulrich Hagen. Strahlentherapie 102, 298-304(1957) Feb. (In German)

5744
HEMATOLOGICAL INVESTIGATION OF THE EFFECT OF PROTECTIVE MATERIAL. PART III. THE EFFECT OF RUTIN ON THE RESULT OF RADIATION REACTION ON BONE MARROW. Helmut Hartweg. Strahlentherapie 102, 305-10(1957) Feb. (In German)

5745
HEMATOLOGICAL INVESTIGATION OF THE EFFECT OF PROTECTIVE MATERIAL. PART IV. ON THE CONDITION OF PERIPHERAL BLOOD PICTURE IRRADIATED AFTER TREATMENT WITH PROTECTIVE SUBSTANCES. Helmut Hartweg. Strahlentherapie 102, 311-14(1957) Feb. (In German)

TOXICOLOGY STUDIES

5746
THE PHARMACOLOGY OF β-AMINOETHYLISOTHIURONIUM BROMIDE IN THE CAT. Victor DiStefano, Daniel E. Leary, and David G. Doherty (Univ. of Rochester School of Medicine and Dentistry, N. Y. and Oak Ridge National Lab., Tenn.). J. Pharmacol. Exptl. Therap. 117, 425-33(1956) August.

TRACER APPLICATIONS

5747 UCRL-3634
California. Univ., Berkeley. Radiation Lab.
METABOLIC STUDIES WITH STRONTIUM-90 IN THE RHESUS MONKEY. Preliminary Report. Patricia W. Durbin, Marshall W. Parrott, Marilyn H. Williams, Muriel E. Johnston, C. Willet Asling, and Joseph G. Hamilton. Jan. 7, 1957. 26p. Contract W-7405-eng-48. $0.25(OTS).

5748 UR-484
Rochester, N. Y. Univ. Atomic Energy Project.
A SEARCH FOR TISSUE-FIXED ANTIBODIES—DISTRIBUTION AND NATURE OF ANTIBODIES AGAINST HORSE SERUM PRODUCED IN RABBITS, RATS, AND GUINEA PIGS. Irving L. Spar, William F. Bale, Dolores E. Wolfe, Ruth L. Goodland, and William Dewey. Mar. 18, 1957. 29p. Contract W-7401-eng-49. $4.80(ph OTS); $2.70(mf OTS).

5749 AEC-tr-2858
THE EFFECT OF SOME METEOROLOGICAL ELEMENTS ON THE DIFFUSION OF RADON IN THE TELLURIC ATMOSPHERE. G. Aliverti and G. Lovera. Translated from Ann. geofis. (Rome) 2, 92-102(1949). 12p.

5750
COMMITTEE ON THE APPLICATION OF ISOTOPIC METHODS TO AGRICULTURAL RESEARCHES ORGANIZED UNDER THE AUSPICES OF THE I.R.S.I.A. 1955–1956 REPORT. GEMBLOUX SECTION. (In French)

5751
A STUDY IN DOGS OF METHODS SUITABLE FOR ESTIMATING THE RATE OF MYOCARDIAL UPTAKE OF Rb^{86} IN MAN, AND THE EFFECT OF L-NOREPINEPHRINE AND PITRESSIN® ON Rb^{86} UPTAKE. W. D. Love and G. E. Burch (Tulane Univ. School of Medicine and Charity Hospital of Louisiana, New Orleans). J. Clin. Invest. 36, 468-78(1957) March.

5752
DIFFERENCES IN THE RATE OF Rb^{86} UPTAKE BY SEVERAL REGIONS OF THE MYOCARDIUM OF CONTROL DOGS AND DOGS RECEIVING L-NOREPINEPHRINE OR PITRESSIN®. W. D. Love and G. E. Burch (Tulane Univ. School of Medicine and Charity Hospital of Louisiana, New Orleans). J. Clin. Invest. 36, 479-84(1957) March.

5753
PROGRESS IN NUCLEAR ENERGY. SERIES VI. BIOLOGICAL SCIENCES. J. C. Bugher, J. Coursaget, and J. F. Loutit, eds. New York, McGraw-Hill Book Co., Inc., 1956. 215p.

Recent developments in the application of nuclear energy in studies of the biological sciences are reviewed. Topics discussed include: modes of radiation injury; genetic effects of radiations; the use of radioactive isotopes in studies on plant genetics, plant nutrition, and plant biochemistry; and applications of radioisotopes in the study of animal biochemistry and mineral metabolism. (C.H.)

5754
KINETICS OF BODY DISTRIBUTION OF PLUTONIUM AS INFLUENCED BY ZIRCONIUM. Marcia White Rosenthal and Jack Schubert (Argonne National Lab., Lemont, Ill.). Radiation Research 6, 349-54(1957) Mar.

CHEMISTRY

5755 AD-105431
Institute of Tech., Wright-Patterson AFB, Ohio.
A STUDY OF THE ATOMATIC CONTROL OF A CONTINUOUS DISTILLATION COLUMN (thesis). Edwin Goodell Park, Jr., and Robert Arthur Vince. Aug. 1956. 58p. (GAO-56).

The application of automatic control to chemical processing and operation has previously been done largely by a trial and error procedure. The purpose of this procedure was to determine modes of control and the suitable constants of these modes which gave the most stable response. Williams and co-workers have developed a theoretical method of accomplishing this evaluation for a continuous distillation column through computations made on a large-scale analog computer. The goal of this thesis has been to check experimentally their results so that the validity of their method could be determined. A small six-plate distillation column was operated to determine the stability afforded by various combinations of control modes and constants. Automatic control for this column was provided by a Foxboro Hyper-Reset Controller and a Foxboro Stabilflo Valve. The results of the experiments indicate that within the limits of the apparatus used, a verification of the work of Williams and co-workers has been obtained. (auth)

5756 AD-107820
Baylor Univ., Waco, Tex.
THE ELECTROCHEMISTRY OF LOW VALENCES OF TITANIUM. Quarterly Progress Report for June 1, 1956 to September 1, 1956. Thomas C. Franklin, Haig Verne Seklemian, and Ronald Poe. Sept. 1, 1956. 28p. Contract AF 33(616)-3331.

Experiments with titanium in organic solvents are described. Divalent Ti has not been demonstrated, but current-voltage curves for Ti dissolution in several organic solvents were obtained. A gas-phase synthesis of Ti^{2+} shows promise. (T.R.H.)

5757 AERE-C/M-301
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE SOLUBILITY OF NEODYMIUM SULPHATE IN WATER AND IN A SODIUM SULPHATE SOLUTION AT HIGH TEMPERATURES. C. J. L. Lock. Jan. 1957. 6p.

The solubilities of $Nd_2(SO_4)_3$ in water and in a Na_2SO_4 solution were measured by tracer methods up to 270°C. The solubility of $Nd_2(SO_4)_3$ in water decreased with temperature. At room temperature, the solubility was much less in 1.6M Na_2SO_4 solution, but at higher temperatures there was very little difference in the solubilities. (auth)

5758 AERE-ED/D-10(Issue 2)
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
SODIUM, (Na). Data Sheet–D.10. Apr. 14, 1955. 15p.

A brief report on the procurement, chemical, nuclear, and physical properties of sodium is presented, together with charts on temperature-corrosion and resistance of materials at 300 and 600°C. (J.E.D.)

5759 AERE-GP/R-1285
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE REDUCTION OF WATER TO HYDROGEN FOR DEUTERIUM CONTENT ANALYSIS. G. R. Clarke. Nov. 19, 1953. 4p.

5760 BMI-1170
Battelle Memorial Inst., Columbus, Ohio
HIGH-TEMPERATURE OXIDATION AND CONTAMINATION OF NIOBIUM. William D. Klopp, Chester T. Sims, and Robert I. Jaffee. Feb. 19, 1957. 25p. Contract W-7405-eng-92. $0.25(OTS).

The oxidation and contamination rates of Nb in O_2 and in air were measured in the temperature range 600 and 1200

C. The oxidation curves in O_2 were linear and the rate constants were correlated by an Arrhenius-type plot. The heat of reaction was 5,410 cal/mole from 600 to 1100 C; above 1100 C the reactions were rapid and the rates could not be correlated to the Arrhenius-type plot. The activation energy for diffusion of O_2 in Nb was calculated from contamination data. Weight-change curves of Nb in air were also linear, with lower rates than in O_2. The heat of reaction was, from the reaction rate data, 10,100 cal/mole from 600 to 1200 C. Contamination in air-reacted Nb was similar to that in O_2-reacted Nb, suggesting that O_2 is the primary diffusing contaminant. (auth)

5761 CCC-1024-TR-231

Wisconsin. Univ., Madison.

STRUCTURES AND THERMODYNAMIC PROPERTIES OF HIGH TEMPERATURE GASEOUS SPECIES IN THE $B_2O_3-H_2O$ SYSTEM. J. L. Margrave, J. R. Soulen, G. E. Leroi, and S. P. Randall. Mar. 14, 1957. 10p. [For Callery Chemical Co. Contract NOa(s)52-1024-c].

Vaporization of liquid B_2O_3 at high temperatures has been studied in inert and moist atmospheres to determine (1) the vapor pressure, heat of vaporization, and the boiling point of B_2O_3; (2) the molecular weight and structures of the major vapor species in oxidizing, reducing, and inert atmospheres, as well as in vacuum; (3) the formulas and stabilities of any gaseous hydroxide (hydrated oxide) species in the presence of water vapor; and (4) thermodynamic equilibrium constants describing this system. In flow measurements, spectroscopic and photometric studies, the major species over B_2O_3 (l) in an inert or oxygen-rich atmosphere was found to be B_2O_3 (g). Direct determinations and extrapolations of lower temperature work indicate a normal boiling point of 2400 ± 100°K for boric oxide, and a heat of sublimation at 0°K of 89 ± 1 kcal./mole. The structure of the gaseous pentatomic molecule is predicted to be a bipyramid of symmetry D_{3h} on the basis of visible and infrared spectral data. When water is added to the flow gas, vaporization of B_2O_3 is greatly enhanced and is easily measurable at 500°C. From studies of weight loss as a function of water, partial pressure, and temperature, it appears that the reaction proceeds to produce gaseous H_3BO_3 and possibly some gaseous HBO_2. Thermodynamic properties and heats of formation may now be evaluated for BO(s and g), B_2O_2(g), B_2O_3(s, l, and g), H_3BO_3(s and g), and HBO_2(s and g), and equilibria calculated for B–H–O systems. (auth)

5762 HW-44888

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE ESTERS OF THE ACIDS OF PHOSPHORUS AS SOLVENTS. L. L. Burger. Jan. 3, 1957. 25p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

A series of alkyl and aryl esters of phosphoric and substituted phosphonic and phosphinic acids as well as some substituted phosphine oxides have been prepared. Their physical properties and extraction behavior for U and Pu have been determined. These organo-phosphorus compounds offer an extremely wide range of physical properties, including solvent strength. An increase in solubility and viscosity, a decrease in density, and a decrease in the stretching frequency of the phosphoryl bond are noted on passing from phosphate to phosphonate to phosphinate to phosphine oxide. The extraction ability of these compounds for U increases in the order phosphate < phosphonate < phosphinate < phosphine oxide. A similar trend was noted for extraction of $Pu(NO_3)_4$ and $Pu(NO_3)_6$ by phosphates, phosphonates, and phosphinates. Electronegative substituents such as chlorine strongly depress the solvent strength of these compounds. Solid complexes formed between several of the compounds and $UO_2(NO_3)_2$ were isolated and identified. (auth)

5763 NAVORD-5009

Naval Ordance Test Station, Inyokern (China Lake), Calif.

OBSERVATIONS ON BUBBLE GROWTHS IN VARIOUS SUPERHEATED LIQUIDS. Paul Dergarabedian. Jan. 26, 1956. 24p. Contract N123s-91875. (NOTS-1345).

Experimental data are presented for the growth of vapor bubbles in various superheated liquids, such as carbon tetrachloride, benzene, ethyl alcohol, and methyl alcohol. These data are compared with the theoretical results obtained by Plesset and Zwick who derived these results by taking into account the heat diffusion across the bubble boundary. The agreement in all cases between experiment and theory is found to be good. The growth of vapor bubbles in slightly superheated water is also presented in the form of experimental data for bubbles just beginning to grow from a point of equilibrium which is presumed to be dynamically unstable. The radii corresponding to the points of equilibrium are of the same order of magnitude as predicted by theoretical considerations. (auth)

5764 NP-6239

Rio de Janeiro. Centro Brasileiro de Pesquisas Fisicas and Brasil. Escola Nacional de Química, Rio de Janeiro.

ISOTOPIC EXCHANGE AND EVOLUTION OF METAL SURFACES IN ELECTROLITIC SOLUTIONS. U. Camerini, J. Danon, and M. Malagolowkin. Dec. 26, 1956. 19p. (Notas de Física Vol. III, No. 8).

Studies of isotopic exchange between several metals and electrolytic solutions are reported using Bi^{212} as tracer. (T.R.H.)

5765 WAL-397/9

Watertown Arsenal Lab., Mass.

A SURVEY OF THE ELEVATED TEMPERATURE PROPERTIES OF TEFLON AND KEL-F. A. P. Levitt and A. K. Wong. Aug. 24, 1956. 53p. Project title: HIGH TEMPERATURE THERMAL PROPERTIES OF FLUOROCARBON PLASTICS.

The results of a literature survey on the elevated temperature thermal, mechanical, and electrical properties of Teflon and Kel-F are presented. Data on the following elevated temperature properties of these materials are reported: specific heat, thermal expansion, decomposition rate and decomposition products, specific volume, mechanical and electrical properties. The available data clearly indicate that at elevated temperatures Teflon is superior in thermal stability and mechanical properties to Kel-F. (auth)

5766 AEC-tr-2846(Pts. I and II)

DISTILLATION OF AQUEOUS NITRIC ACID AND OF NITRIC ACID–SULFURIC ACID MIXTURES. E. Berl and O. Samtleben. Translated by K. S. Bevis (Pt. I) from Z. angew. Chem. 5, 201-2(1922). 7p. (Pt. II) ibid. 206-11. 17p.

5767 AEC-tr-2852

LIMITS OF HOMOGENEITY AND DEPENDENCE OF THERMODYNAMIC AND CERTAIN OTHER PROPERTIES OF TANTALUM CARBIDE PHASES ON THEIR COMPOSITION AND STRUCTURE. V. I. Smirnova and B. F. Ormont. Translated from Zhur. Fiz. Khim. 30, 1327-42(1956). 26p.

The system Ta–C is investigated by analytical methods developed and described here. The homogeneity limits thermodynamic properties, abrading properties and electrical resistance approximations are reported. (T.R.H.)

5768 AEC-tr-2859

THE ACIDITY FUNCTION OF AQUEOUS SOLUTIONS OF HCl AND OF THE SYSTEM $P_2O_5-H_2O$ AT VARIOUS TEMPERATURES. A. N. Gelbshtein, G. G. Shcheglova, and M. N. Temkin. Translated from Zhur. Neorgan. Khim. 1, 282-97(1956). 21p.

The dependence of the acidity function on temperature was measured by the indicator method for aqueous HCl and aqueous P_2O_5 solutions. (T.R.H.)

5769 AERE-Lib/Trans-693

SOME PHYSICO-CHEMICAL CONSTANTS OF HEAVY OXYGEN WATER. N. M. Zhavoronkov, O. V. Uvarov, and N. N. Sevryugova. Translated by R. C. Murray from Primensenie Mechenykh Atomov v Anal. Khim., Akad. Nauk S.S.S.R., Inst. Geokhim. i Anal. Khim im. V. I. Vernadskogo, 223-33(1955). 14p.

The coefficient of relative volatility for the $H_2O^{16}-H_2O^{18}$ system has been determined between 20 to 92°C, and an equation for its variation with temperature has been fitted to the result. The values of α are close to those obtained by Riesenfeld and Chang and by Urey and Wahl, for moderate temperatures, but there is some deviation from those of Riesenfeld and Chang at high, and those of Wahl and Urey at low, temperatures. There was good agreement between the values of α obtained by two methods used in this work. All determinations were carried out with water enriched in H_2O^{18} to 1.1–1.4 mole % by rectification, with subsequent removal of deuterium oxide chemically. From the values of α obtained we have calculated the difference in heats of volatilization of H_2O^{18} and H_2O^{16} at 100°C and the V. P. of heavy oxygen water between 15 and 100°C, and also the b.p. of H_2O^{18}. (auth)

5770 IGRL-T/CA-35

ON THE ISOTOPIC SHIFT IN THE SPECTRUM OF BORON. S. Mrozowski. Translated by Tyson Rigg from Z. Physik 112, 223-33(1939). 7p.

The spectrum of B, excited in a hollow-cathode discharge, has been examined with a high-resolution spectroscopic device. It has been found that both lines of the BI doublet (2497/8 A) exhibit an asymmetry in the direction of shorter wavelength. Photometric examination reveals that this can be explained on the basis of a shift in the B^{11} line, as compared with the B^{10} line, of about -0.17 cm^{-1}. The doublet shows an intensity ratio of $1:2.04 \pm 0.08$. The BII-line at 3451 A consists of two components corresponding to the two isotopes, the shift in this case being about $+0.877$ cm^{-1}. The specific isotopic shifts are thus about -0.37 cm^{-1} (B I) and $+0.734$ cm^{-1} (B II). The mean abundance ratio found for the B^{11}/B^{10} isotopes is 3.95 ± 0.10. (auth)

5771

ON THE MODE OF ACTION OF X-RAY PROTECTIVE AGENTS. II. INTERACTION BETWEEN BIOLOGICALLY IMPORTANT THIOLS AND DISULFIDES. Lorentz Eldjarn and Alexander Pihl (Norwegian Radium Hospital, Oslo, Norway). J. Biol. Chem. 225, 499-510(1957) Mar.

A method was developed to study the thiol-disulfide interactions. The method involves the isolation and direct measurement of the amounts of S^{35} labeled mixed disulfide present in reaction mixtures. Data are presented for the systems glutathione–N, N′-diacetylcystamine (GSH + $(ACRS)_2$) and for glutatione–cystamine (GSH + RSSR). (W.L.H.)

5772

THE PREPARATION OF ANYDROUS THORIUM TETRACHLORIDE. O. C. Dean and J. M. Chandler (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, 57-72 (1957) Feb.

Thorium tetrachloride is an important intermediate in the production of Th metal. The readiness with which the hydrated salt hydrolyzes at high temperatures with its own water of hydration makes use of the anhydrous salt necessary for this purpose. The preparation of pure anhydrous $ThCl_4$ from aqueous solutions is very nearly impossible because of its hydrolytic behavior. The dry chlorination of the oxide, oxalate, carbonate, carbides, sulfides, and nitrate with various chlorinating agents has been evaluated on a laboratory scale. Chlorination of the oxide, oxalate, and carbonate in the presence of carbon and direct chlorination of the carbide with chlorine appear to be the most promising methods. The results of laboratory studies of the ThO_2-C-Cl_2, the $Th(C_2O_4)_2-CCl_4-Cl_2$, and the $Th(C_2O_4)_2-CO-Cl_2$ systems on a 1-lb batch scale are presented. Flowsheets, optimum conditions, and the thermochemistry of the reactions involved are discussed. (auth)

ANALYTICAL PROCEDURES

5773 AERE-C/R-1150

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EFFECT OF OXYGEN ISOTOPES IN THE ANALYSIS OF PLUTONIUM ISOTOPES USING PLUTONIUM OXIDE ION BEAMS IN THE SOLID SOURCE MASS SPECTROMETER. G. R. Hall and G. H. Palmer. Mar. 11, 1953. Decl. Dec. 12, 1956. 7p.

The effect of O_2 isotopes in the analysis of Pu isotopes using PuO_2^+ and PuO^+ beams is discussed. Equations are given which allow for the correction of the observed peak heights and for the calculation of the Pu isotopic abundances. For a sample containing 0.1% Pu^{241}, and for peaks of mass 273, about 75% of the observed peak height is due to the ions $[Pu^{239}\ O^{16}\ O^{18}]^+$, $[Pu^{239}\ O^{17}\ O^{17}]^+$ and $[Pu^{240}\ O^{16}\ O^{17}]^+$. (auth)

5774 AERE-C/R-1553

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

POLAROGRAPHIC THEORY. PART I. THE INFLUENCE OF NON-UNIFORM MERCURY FLOW AND INTERMITTENT POLARIZATION ON THE DIFFUSION CURRENT. G. C. Barker. Nov. 15, 1954. Decl. Nov. 26, 1956. 15p.

Approximate expressions are derived for the concentration gradient in the solution at the surface of a drop electrode whose surface area is a function of the time f(t) when the drop is polarized for the whole or part of its life. (auth)

5775 AERE-C/R-1606

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SQUARE WAVE POLAROGRAPHY. PART V. ORGANIC ADSORPTION-DESORPTION WAVES. G. C. Barker and A. W. Gardner. Nov. 1, 1955. Decl. Nov. 20, 1956. 28p.

The cause of organic adsorption-desorption waves is discussed in detail. An equivalent electrical circuit for the electrode-solution interface is derived which is shown to be in agreement with the experimental facts in the case of solutions containing secondary octyl alcohol. (auth)

5776 CCC-1024-TR-226

Pittsburgh. Univ.

COLORIMETRIC DETERMINATION OF BORON–HYDROGEN COMPOUNDS WITH PHOSPHOMOLYBDIC ACID. W. H. Hill, J. M. Merrill, and R. H. Larsen. Mar. 5, 1957. 13p. [For Callery Chemical Co. Contract NOa(s)-52-1024-c].

An analytical procedure was developed for the microdetermination of B in $B-H_2$ compounds. The addition of phosphomolybdic acid to decaborane, dimethylamineborane, or sodium borohydride produced blue solutions,

whose color intensities were directly related to the B content. Exact timing of the procedure is necessary because the color intensity increases with time in the case of decaborane and decreases with time in the case of the sodium borohydride. (auth)

5777 CCC-1024-TR-230
Richmond, Va. Univ.
CURCUMIN (TURMERIC) METHOD FOR SPECTROPHOTOMETRIC DETERMINATION OF BORON. W. Powell, E. Hardcastle, and H. Poindexter. Mar. 12, 1957. [For Callery Chemical Co. Contract NOa(s)-52-1024-c].

The curcumin (turmeric) method is the most sensitive (four times as sensitive as the 1, 1'-dianthrimide method) spectrophotometric method available for the determination of B. The method is relatively simple, few steps are involved, there are few sources of error, and the reproducibility is good. The sensitivity is not dependent on the solvent; Beer's law is followed for all solvents. Frequent standardization is not necessary unless greater than 5 or 10% accuracy is desired. Oxalic acid increases the sensitivity of the method. (auth)

5778 CEA-523
France. Commissariat a l'Energie Atomique, Paris.
APPLICATION DES RADIOELEMENTS A L'ANALYSE CHIMIQUE. (Application of Radioelements to Chemical Analysis). Ch. Fisher. 1956. 4p.

A brief description of activation analysis, isotopic dilution analysis, and analytical chemistry uses of radioisotopes is given. Examples used are activation determination of Na in Pb and U in ores, and determination of Nb and Ta in a mixture of their oxides by use of a radioactive tracer and chemical analysis. (T.R.H.)

5779 IGO-AM/CA-79
Gt. Brit. Capenhurst Works, Capenhurst, Ches., England.
THE DETERMINATION OF α-ACTIVITY DUE TO URANIUM IN HUMAN URINE. W. Fletcher. Feb. 28, 1957. 6p.

A method is described for the radiometric determination of U in human urine. (C.H.)

5780 NAA-SR-1720
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
GRAVIMETRIC DETERMINATION OF BARIUM IN ZIRCONIUM METAL AND IN CERTAIN ZIRCONIUM SALTS. Louis Silverman and Katherine Trego. Apr. 1, 1957. 17p. Contract AT-11-1-GEN-8. $0.20(OTS).

Barium may be determined gravimetrically in hydrated zirconyl chloride and in Zr metal. Since Zr interferes in the precipitation of Ba as $BaSO_4$, a method is described for the complete separation of the Zr (and Fe) before the final determination of the Ba. The bulk of the Zr is removed by two filtrations at controlled acidities; a cupferron precipitation-chloroform extraction separates any residual Zr. Gravimetric studies made for the precipitation of Ba ranging from 0.2 to 2.0 mg indicated that best results are obtained by the addition of a large excess of $(NH_4)_2SO_4$. (auth)

5781 NBL-128
New Brunswick Lab., AEC, N. J.
A METHOD FOR THE DETERMINATION OF RADIUM IN ORES AND RESIDUES. J. E. Hudgens, R. C. Meyer, C. Zyskowski, and L. C. Nelson. Mar. 1957. 20p. $0.20 (OTS).

A method for the determination of the Ra content of ores and U processing residues has been developed. Samples were packed into 12-ml, glass vials, the vials sealed and the gamma ray activity of the Ra detected after a growth period of 30 days. A high-pressure ionization chamber was used as a detector and the gamma rays were filtered through $^3/_8$ inch of Pb to minimize the detection of the low energy part of the Ra gamma ray spectrum. The large sample size used in the method decreases the importance of sample inhomogeneity. Corrections are applied for UX and actinium series gamma rays, and for absorption of Ra gamma rays in the sample material and in the aqueous Ra standard. The magnitude of the correction for the self absorption of Ra gamma rays in the sample material was evaluated by using three methods. In the first method, synthetic standards containing known quantities of Ra were used. In the second, the slope of the curve for ion current per gram of sample as a function of the number of grams contained in 12 ml. vials was calculated for a large number of samples. In the third, the absorption of Ra gamma rays by representative ores and residues was determined by using a Ra source and a sodium iodide crystal scintillation counter. The radium content of a homogeneous sample can be established with a precision equivalent to a standard deviation of ±0.1 to 0.4%. (auth)

5782 WIN-63
National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.
IMPROVEMENTS IN THE FLUOROMETRIC DETERMINATION OF URANIUM. Frederick A. Centanni and Thomas J. Morrison, Jr. Apr. 3, 1957. 22p. Contract AT(49-6)-924. $4.80(ph OTS); $2.70(mf OTS).

Modifications in the instrumentation and method used in the fluorometric determination of U are reported. The elimination of the reference source in the Galvanek-Morrison Fluorimeter has improved the operating stability of the instrument and simplified its operation. Also reported is an automatic fusion burner unit, which minimizes the atmosphere-temperature fluctuations and makes possible better reproducibility and greater accuracy in the uranium determination. (auth)

5783
DETERMINATION OF TITANIUM IN PLUTONIUM–TITANIUM ALLOYS. Karl S. Bergstresser (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 29, 532-4(1957) April.

Titanium in Pu–Ti alloys can be determined by adding H_2O_2 to a perchloric acid solution of the sample. A colored solution with Ti and a precipitate of Pu are formed simultaneously. The insoluble plutonium peroxide is removed by centrifuging before the titanium peroxy complex is measured colorimetrically. The method is applicable from 0.1 to 1.0% titanium. A standard deviation of 2 γ is observed for samples containing from 50 to 500 γ of Ti and 50 mg. of Pu. Thorium does not interfere, but U and Nb do. (auth)

5784
SEPARATION AND DETERMINATION OF MICROGRAM QUANTITIES OF ZIRCONIUM. Clark E. Bricker and Glenn R. Waterbury (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 29, 558-62(1957) April.

The recommended procedure has been applied to the analysis of samples of Pu alloys and to solutions containing a wide variety of metallic ions. Its reproducibility with multiplicate samples is within 3% in all analyses where 15 or more γ of Zr are present. Even though a single analysis may require 4 to 5 hours, 12 analyses can be performed simultaneously in about 6 hours. (auth)

5785
COMPLEXOMETRIC TITRATIONS FOLLOWING CUPFERRON SEPARATION OF INTERFERENCES. James S. Fritz, Marlene Johnson Richard, and Ann Sutton Bystroff (Iowa State Coll., Ames). Anal. Chem. 29, 577-9(1957) April.

The cupferron complexes of tri- and quadrivalent metals can be extracted from water into an immiscible organic

solvent and thus separated from most divalent metal ions. With a 1 to 1 mixture of benzene and isoamyl alcohol, the separation is quantitative in a single extraction. The optimum pH range for the extraction is approximately 0.3 to 1.0. The divalent metals remaining in the aqueous phase may be determined by titration with (ethylenedinitrilo) tetraacetic acid EDTA). Data are given for the titration of Mg, Ca, Mn, Zn, Cd, Pb, Co, and Ni following separation from Fe, Th, Zr, Ti, Sn, or Bi. Separation from Al, Cu, or rare earths is incomplete by this method. (auth)

5786

AUTOMATIC OPERATIONS IN ANALYTICAL CHEMISTRY. Gordon D. Patterson, Jr. (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.). Anal. Chem. 29, 605-14(1957) April.

The subject of this review is divided into sections on general trends, sampling, separating the desired constituent, and measurements. The types of measurement considered are gravimetry, volumetry and manometry, densimetry and viscometry, magnetometry, thermometry, titrimetry, sonimetry, emissimetry, absorptiometry (infrared, light, ultraviolet, and x-ray), thermoconductivity, refractometry, reflectometry, conductometry, potentiometry currentimetry, dielectrimetry, and radioactimetry. Data analysis techniques are reviewed. 254 references. (T.R.H.)

5787

FERROUS METALLURGY. H. F. Beeghly (Jones & Laughlin Steel Corp., Pittsburgh). Anal. Chem. 29, 638-43 (1957) April.

Methods for analysis of ferrous materials are reviewed. The materials included are Al, As, B, C, Ce, Cr, Co, Nb, Cu, Pb, Mg, Mn, Ni, P, Si, S, Te, Sn, Ti, W, V, Zr, gases and nonmetallic compounds, slags and refractories. The uses of activation and tracer methods are included. 181 references. (T.R.H.)

5788

NONFERROUS METALLURGY. M. L. Moss (Aluminum Co. of America, New Kensington, Penna.). Anal. Chem. 670-8(1957) April.

A review with 271 references is presented. The information is tabulated so that references for a particular determination or analysis are easily located. (T.R.H.)

5789

WATER ANALYSIS. S. K. Love and L. L. Thatcher (U. S. Geological Survey, Washington). Anal. Chem. 29, 722-34 (1957) April.

A review of the field of water analysis is presented including 302 references. Only those papers which at present command considerable attention or which appear to have a basic, longterm significance are included. Included are sections on analysis for detergents, U, Ra, and Th. Also discussed are radioactivity and isotopic analysis. (T.R.H.)

5790

TITRATION OF BASIC GROUPS IN ION-EXCHANGE RESINS WITH PERCHLORIC ACID IN GLACIAL ACETIC ACID. G. E. Ficken and E. S. Lane (Atomic Energy Research Establishment, Harwell, Didcot, Berks). Anal. Chim. Acta 16, 207-9(1957) Mar.

A non-aqueous titrimetric procedure is described for the determination of basic functional groups in ion exchange resins. (auth)

5791

ESTIMATION OF FLUORINE IN MICROGRAMME QUANTITIES. A MODIFIED PROCEDURE. G. V. L. N. Murth, T. S. Viswanathan, and V. Ramakrishna (Tata Iron & Steel Co., Ltd., Jamshepdur, India). Anal. Chim. Acta 16, 213-15 (1957) Mar.

A procedure is described for the estimation of F_2 in microgram quantities by the steam-distillation of the samples with H_2SO_4 or H_3PO_4 acid. Traces of the acid carried over are precipitated from the distillate as Ag or Ba salts, in order to eliminate their interference in the subsequent titration of F_2. The results obtained compare favorably with those of the conventional ClO_4 method. By avoiding the latter, the present method offers the advantage of both safety and simplicity. (auth)

5792

EXTENSION OF THE ISOTOPIC METHOD FOR THE DETERMINATION OF OXYGEN IN TITANIUM. A. D. Kirshenbaum and A. V. Grosse (Temple Univ., Philadelphia, Penna.). Anal. Chim. Acta 16, 225-7(1957) Mar.

A method of isotopic elementary analysis has recently been applied to the determination of O_2 in metals. It is now extended to the determination of O_2 in Ti in the low range of 0.04 to 0.2 wt. % O_2. The method has the great advantage that it gives quantitative results without a quantitative separation of O_2 in any form. In the samples analyzed it was found that the alternative vacuum-fusion method gives results which are 9 to 13% too low. (auth)

5793

DETERMINATION OF ACTIVE TITANIUM IN TITANIUM POWDER USED IN PYROTECHNICS. M. Codell, R. P. Egan, and G. Norwitz (Frankford Arsenal, Philadelphia, Penna.). Anal. Chim. Acta 16, 228-33(1957) Mar.

Possible approaches to the problem of determining active Ti in Ti powder used for pyrotechnics are discussed. A method is proposed for the determination whereby the sample is dissolved in a mixture of fluoboric and sulfuric acids and the volume of H_2 evolved in the reaction measured. An improved eudiometer is described. (auth)

5794

ANALYSIS OF THE TERPHENYLS BY A COMPRESSED PELLET INFRARED METHOD INVOLVING MICRO-DISTILLATION. Eugene L. Colichman, Raymond F. Fish, and George O. Bjarke (Atomics International, North American Aviation, Inc., Canoga Park, Calif.). Anal. Chim. Acta 16, 250-8(1957) Mar.

A quantitative compressed pellet infrared method used together with a micro-distillation to effect separation of the isomer has been developed and reported here for the analysis of ortho-, meta-, and para-terphenyl. The terphenyl content is determined on fractions isolated by distillation from radiation damaged samples. The compressed pellet infrared method is preferred instead of the more conventional solution technique since smaller quantities of isolated terphenyl are required. The pellet method is applicable also to polyphenyls higher than the terphenyls. The solution technique is not due to the insolubility of the polyphenyls. It is expected that the compressed pellet spectral method developed here might well find application in the analysis of compounds other than polyphenyls. (auth)

5795

DETERMINATION OF URANIUM BY AMMONIUM THIOSULPHATE AND SODIUM HYPOPHOSPHITE. H. N. Rây and N. P. Bhattacharayya (Indian Ordnance Dept., Ichapore, W. Bengal, India). Analyst 82, 164-6(1957) Mar.

Uranium is determined gravimetrically by precipitation as the greenish phosphate from dilute mineral-acid solution by means of $Na_4P_2O_6 \cdot 10H_2O$ and $(NH_4)_2S_2O_3$; the precipitate is ignited at 900° C, the S present being removed during the ignition. Elements forming sulfides insoluble in dilute mineral acids are removed by treatment with H_2S, and Zr and Ti, the only interfering elements, are removed by treatment with $NaP_2O_6 \cdot 10H_2O$ alone. The method has been sucessfully applied to the determination of U in steel. (auth)

5796

THE DETERMINATION OF LITHIUM, SODIUM AND PO-

TASSIUM IN MIXTURES WITH THE "EEL" FLAME PHOTOMETER. W. A. Stuart, M. Simpson, and W. H. Hardwick (Atomic Energy Research Establishment, Harwell, nr. Didcot, Berks). Analyst 82, 200-3(1957) Mar.

5797

AN AMPEROMETRIC TITRATION OF TITANIUM. R. P. Graham and E. VanDalen (McMaster Univ., Hamilton, Ontario). Can. J. Chem. 35, 418-21(1957) Apr.

A procedure is presented for the amperometric titration Ti^{4+} using m-nitrophenylarsonate. W.L.H.)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

5798 AECU-3428

Knolls Atomic Power Lab., Schenectady, N. Y.

RAPID LATTICE PARAMETER MEASUREMENTS OF MODERATE PRECISION ON SINGLE CRYSTALS. Charles W. Tucker, Jr., and Peter Senio. [1956]. 5p. Contract [W-31-109-Eng-52]. (M-5986). $1.80(ph OTS); $1.80(mf OTS).

Using CdO as a reference material and rocking over a limited angular range, the lattice parameters of a number of cubic single crystals have been determined. Results were obtained on LiF, MgO, KCl, KBr, NaCl, KI, and Ge. The average deviation from the average values was only 0.006%, while the average deviation from literature values was only 0.02%. The method is suggested for parameter measurements in which moderate precision, accuracy, and speed with simple techniques are required. (auth)

FLUORINE AND FLUORINE COMPOUNDS

5799 AEC-tr-2877

FLUORINE AND ITS COMPOUNDS. (Ftor I Yego Soyedineniya). I. L. Knunyants and A. V. Fokin. Translated from Priroda 44, 3-19(1955). 25p.

The following topics are discussed: fluorine and its inorganic derivatives; preparation of fluorocarbons by catalytic, metallo-fluoride, and electrochemical processes; properties of fluorocarbons; and application of organic fluorides to lubricating materials, plastics, refrigerants, fire extinguishing agents, fire-resistant materials, dyes, and insecticides. (W.L.H.)

5800

ELECTROCHEMICAL FISSION OF THE CARBON–FLUORINE BOND. pH-DEPENDENCY OF THE PROCESS. Philip J. Elving and Joseph T. Leone (Univ. of Michigan, Ann Arbor). J. Am. Chem. Soc. 79, 1546-50(1957) Apr. 5.

Phenacyl fluoride gives two well-defined, diffusion-controlled cathodic polarographic waves, the first resulting from fission of the carbon–fluorine bond and the second from reduction of the acetophenone formed on fluorine removal. The former represents the first case of carbon–fluorine bond fission at the D.M.E. and the first instance where the carbon–halogen bond fission per se has been found to be pH-dependent. A mechanism involving induced polarization of the carbon–fluorine bond by the electrode and by hydrogen ion via the hydrogen fluoride bond in the transition state or species, has been postulated to explain the pH-dependence observed for the first wave below pH 6. With decreasing hydrogen ion concentration, the effect decreases and the first wave becomes pH-independent. (auth)

GRAPHITE

5801

FAST NEUTRON DAMAGING IN NUCLEAR REACTORS. I. RADIATION DAMAGE MONITORING WITH THE ELECTRICAL CONDUCTIVITY OF GRAPHITE. W. Primak and L. H. Fuchs (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, 49-56(1957) Feb.

A method for using a saturating property to formulate a linear dosage scale is developed. The method is applied to the determination of the radiation damage rate for graphite in a nuclear reactor using the per cent decrease in electrical conductivity as the property. The damage rates in a number of irradiation facilities of the CP-3, CP-3', and X-10 reactors are given. It is conclusively shown that the thermal neutron flux cannot be used to indicate the damage rate, for the one can be varied by more than an order of magnitude with respect to the other. (auth)

5802

NEUTRON TEMPERATURE MEASUREMENTS IN GRAPHITE. M. Kiichle. Nuclear Sci. and Eng. 2, 87-95(1957) Feb.

In various graphite piles, where one or two Ra-Be sources were producing a stationary neutron field, the neutron temperature was measured by activating an In foil, sandwiched between two Au absorbers. The neutron temperature was found to be up to 70°C above the graphite temperature, which is explained by the incomplete thermal equilibrium. (auth)

5803

POSSIBLE INTERPRETATION OF CYCLOTRON RESONANCE ABSORPTION IN GRAPHITE. Benjamin Lax and H. J. Zieger (Massachusetts Inst. of Tech., Lexington). Phys. Rev. 105, 1466-8(1957) March 1.

An interpretation of cyclotron absorption experiments in graphite is presented. Evidence is given for the existence of a majority and minority hole, and a majority and minority electron. The masses for the majority hole and electron are $\sim 0.07\ m_0$ and $\sim 0.05\ m_0$, respectively. The masses for the minority hole and electron are $0.028\ m_0$ and $0.015\ m_0$, respectively. Strong indications of second and third harmonic cyclotron resonances for the minority carriers, and weaker indications of harmonics for the majority carriers are noted. Based on the assumption that these lines are correctly interpreted as harmonics, selection rules for harmonics of the cyclotron resonance exclude certain positions of the band extrema in the Brillouin zone. (auth)

LABORATORIES AND EQUIPMENT

5804

INERT-ATMOSPHERE DRY BOX. Thomas R. P. Gibb (Tufts Univ., Medford, Mass.). Anal. Chem. 29, 584-7 (1957) April.

The design of a dry box for analytical manipulations, such as weighing, grinding, and transferring in an atmosphere of inert gas, particularly N_2, is presented. (W.L.H.)

RADIATION CHEMISTRY

5805

RADIATION CHEMISTRY STUDIES WITH CYCLOTRON BEAMS OF VARIABLE ENERGY: YIELDS IN AERATED FERROUS SULFATE SOLUTION. Robert H. Schuler and Augustine O. Allen (Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 79, 1565-72(1957) Apr. 5.

Yields of Fe^{2+} oxidation and of H_2 gas evolution in air- or O_2-saturated solutions of $FeSO_4$ in 0.8 N H_2SO_4 have been determined for beams of He ions and deuterons of various energies. From the results, the yields of total net water decomposed and of H_2 atoms produced are found. The results are compared with those reported in the literature for various types of radiation, and are discussed in terms of the free radical model of water radiolysis. (auth)

5806

C^{13}-ISOTOPE EFFECT IN THE PHOTOLYSIS OF ETHYL BROMIDE. H. L. Friedman, R. B. Bernstein, and H. E. Gunning (Illinois Inst. of Tech. Chicago). J. Chem. Phys. 26, 528-32(1957) March.

The photolysis of C_2H_5Br in a tenfold excess of cyclopentane has been studied over the temperature range, 30 to 250°C. Ethane is the principal volatile product of reaction. The quantum yield of C_2H_6 formation has been found to be unity at 30°C. An increase in apparent quantum yield to 1.5 at 250°C was observed. This increase is attributed to the greater absorption of the incident radiation at high temperatures. The C^{12} enrichment in the C_2H_6 product was 1.0070 ± 0.0008, and invariant in temperature. The isotope fractionation effect is explained on the basis of the higher absorption of $C^{12}-C^{12}-Br$ over $C^{12}-C^{13}-Br$ in the long wavelength region. (auth)

5807

CHEMICAL EFFECTS IN (γ,n) REACTIONS. A. N. Murin, et al. Uspekhi Khim. 26, 164-75(1957) Feb. (In Russian)

A general review is given on photonuclear reactions, radioactive isotope enrichment, and the chemical state of atoms formed by the (γ,n) reaction. Tables of photonuclear reactions of 75 various nuclei and of the enrichment of various elements are given. (R.V.J.)

RADIATION EFFECTS

5808 NP-6244

Stanford Research Inst., Menlo Park, Calif.

THE EFFECT OF NUCLEAR RADIATION ON STRUCTURAL ADHESIVES AND PLASTICS. Bimonthly Report No. 5 [for] December 15, 1956 to February 15, 1957. R. Y. Mixer. Feb. 15, 1957. 11p. SRI Project No. SU-1726. Contract AF33(616)-3632.

Some experiments with radiation effects on laminating resins, lap-shear specimens, adhesives, and plastics are reported. (See also NP-6098.) (T.R.H.)

5809

X-RAY INDUCED CRACK FORMATION IN SODIUM CHLORIDE. H. R. Leider, L. A. Girifalco, and R. A. Lad (Lewis Flight Propulsion Lab., Cleveland, Ohio). Acta Met. 5, 216-18(1957) Apr.

X irradiation of powdered NaCl produces a large surface-area increase and a decrease in the net heat of adsorption. The results are interpreted in terms of a cracking mechanism by which strain energy introduced by grinding and by X rays is dissipated. It is shown that the cracking process occurs even in the absence of X rays but much more slowly and to a lesser extent. (auth)

5810

INACTIVATION OF DEOXYRIBONUCLEASE BY X-RAYS. II. THE KINETICS OF INACTIVATION IN AQUEOUS SOLUTION. Shigefumi Okada (Univ. of Rochester School of Medicine and Dentistry, N. Y.). Arch. Biochem. Biophys. 67, 102-12(1957) Mar.

5811

INACTIVATION OF DEOXYRIBONUCLEASE BY X-RAYS. III. MODIFICATION OF THE EFFECT OF RADIATION ON THE DNA-DNase SYSTEM. Shigefumi Okada (Univ. of Rochester School of Medicine and Dentistry, N. Y.). Arch. Biochem. Biophys. 67, 113-20(1957) Mar.

5812

STIMULATION OF BRANCHED CHAIN REACTIONS BY THE ACTION OF PENETRATING RADIATION IN THE INITIAL PERIOD OF THE DEVELOPMENT PROCESS. N. M. Emanuel. Doklady Akad. Nauk S.S.S.R. 111, 1286-9(1956) Dec. 21. (In Russian)

Effects of γ radiation in stimulating the chain reaction in the oxidation of paraffin and other hydrocarbones were studied. Diagrams of stimulated oxidation curves and kinetic curves of products originated in chain reaction with degenerated branching are shown. (R.V.J.)

5813

RADIATION EFFECT ON POLYMER VIBRATION CHARACTERISTICS. C. D. Bopp, W. K. Kirkland, Oscar Sisman, and R. L. Towns (Oak Ridge National Lab., Tenn.). Ind. Eng. Chem. 49, 718-21(1957) Apr.

The vibrating reed resonance technique was employed to measure radiation effects on polymers. The dynamic elastic and frictional properties at room temperature are measured in the range 50 to 500 cps in polymers in which radiation-induced cross-linking occurs. (T.R.H.)

5814

EFFECT OF IONIZING RADIATIONS ON GLUCOSE SOLUTIONS. Christine T. Bothner-By and Endre A. Balazs (Massachusetts Eye and Ear Infirmary and Harvard Medical School, Boston). Radiation Research 6, 302-17(1957) Mar.

RARE EARTHS AND RARE-EARTH COMPOUNDS

5815

A NEW METHOD OF PREPARATION OF ANHYDROUS ACETATES OF RARE-EARTH ELEMENTS. S. Panda and D. Patnaik. J. Indian Chem. Soc. 33, 877-8(1956) Dec.

The anhydrous acetates of thorium, cerium and lanthanum have been prepared by the action of the respective nitrate on acetic anhydride. This method can be applied, in general, for preparation of the acetates of other rare earths and elements, the nitrates of which are partially soluble in acetic anhydride. (auth)

5816

SOME PHYSICAL PROPERTIES OF THE RARE EARTH METALS. F. H. Spedding, S. Legvold, A. H. Daane, and L. D. Jennings. Progr. in Low Temperature Phys. 2, 368-94(1956).

The rare earth metals are soft and have a low Debye temperature. They have low coefficients of expansion, comparable to those of glasses. In addition, the room temperature resistivities are high. (W.L.H.)

SEPARATION PROCEDURES

5817 CRCE-676

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

A PRELIMINARY DESIGN AND COST ESTIMATE FOR A DUAL-PURPOSE PROCESSING PLANT. D. H. Charlesworth. Nov. 1956. 28p. (AECL-424).

A preliminary design and cost estimate have been prepared for a dual-purpose processing plant capable of processing 1500 lb of U or 8.09 Kg of Pu, as Pu–Al alloy, daily. Dissolving facilities are not included. The estimated capital cost of the plant is $3,750,000. Daily operating costs are $4,370 when processing U and $4,320 when processing Pu fuel. It is estimated that the integration of U and Pu processing by the use of the same process equipment for both types of fuels results in a saving of 21% in capital cost and 28% in operating cost as compared to the use of separate facilities. (auth)

5818 FPSD/P-13

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England].

THE REMOVAL OF FISSION PRODUCTS FROM SOLUTION WITH A PRECIPITATOR-COLUMN TREATMENT.

PART I. LABORATORY TRIALS. K. G. Seedhouse, J. Monahan, and G. Wallis. [1955?]. 31p.

A synthetic effluent has been treated in a Sludge Blanket Precipitator with 80 ppm PO_4, 40 ppm Fe^{3+}, at a pH of 11.5, being then passed through soil columns to achieve further activity removal. The decontamination in the Precipitator was 95 to 96%, the remaining activity consisting of 40% Ru and 60% Cs. All the Cs, and most of the Ru was removed in the columns, resulting in over 99% over-all removal of all the radioactivity. By employing long columns or columns in series, a decontamination factor of 10^3 can be achieved. Serious defects have been observed with Nuneham Courtenay Greensand. These can partly be remedied by conditioning with polyelectrolytes, quaternary ammonium compounds, and silicones. Vermiculite is to be tested as an alternative column adsorbent, its properties appearing to be ideal. Tests which are being made on the use of two precipitators, the second one employing a ferrous sulfide 'blanket' to remove Ru, are giving very promising results. (auth)

5819 AEC-tr-2865

INVESTIGATIONS INTO THE ENRICHMENT OF ORES AND HYDROMETALLURGY OF RARE AND RADIO-ACTIVE METALS. I. N. Plaksin. Translated by J. Adam from Vestnik Akad. Nauk S.S.S.R. 26, 57-60(1956). 8p.

Methods for the concentration of U and rare earth ores are discussed. (W.L.H.)

5820

SEPARATION OF BISMUTH FROM URANIUM USING THIOACETAMIDE PRECIPITATION. G. A. Stoner and H. L. Finston (Brookhaven National Lab., Upton, N. Y.). Anal. Chem. 29, 570-1(1957) April.

This work was initiated to find a suitable means for the removal of Bi from small amounts of U allowing for a subsequent determination of the latter. It was found that bismuth sulfide could be precipitated from a homogeneous solution using thioacetamide with no apparent loss of U. A rapid, quantitative method for the separation of Bi from microgram quantities of U was obtained permitting the routine analysis of U. (auth)

5821

URANIUM RECOVERY FROM WET PROCESS PHOSPHORIC ACID. Bruce F. Greek, Otis W. Allen, and Donald E. Tynan (International Minerals & Chemical Corp., Bartow, Fla.). Ind. Eng. Chem. 49, 628-38(1957) Apr.

The processes now in use for separating U from phosphate rock are described. The plants using these processes are operating in conjunction with fertilizer and chemical manufacture. The contribution of this program to U. S. production of U is discussed. (T.R.H.)

5822

IMPROVED MOLYBDENUM SEPARATION PROCEDURE. E. M. Scadden (U. S. Naval Radiological Defense Lab., San Francisco). Nucleonics 15, No. 4, 102(1957) Apr.

A modified method is presented for determining Mo activity in fission-product mixtures. (W.L.H.)

TRANSURANIC ELEMENTS AND COMPOUNDS

5823

THE HEATS OF FORMATION OF AmO_2^+(aq) AND AmO_2^{++}(aq) IN 1 M $HClO_4$. S. R. Gunn and B. B. Cunningham (Univ. of California, Berkeley). J. Am. Chem. Soc. 79, 1563-5(1957) Apr. 5.

The heats of reaction of AmO_2^+(aq) and AmO_2^{2+}(aq) with Fe^{2+}(aq) in 1 M $HClO_4$ have been measured to be -72.2 ± 1.0 and -99.1 ± 0.2 kcal., respectively. From these and other thermodynamic data the heats of formation of AmO_2^+(aq) and AmO_2^{2+}(aq) are calculated to be -207.7 ± 2.9 and -170.8 2.7 kcal., respectively. The entropy difference $S_{AmO_2^{2+}(aq)} - S_{AmO_2^+(aq)}$ is calculated to be -16 ± 4 e.u., and a self-consistent potential scheme for the various oxidation states of americium is given. A modified microcalorimeter used in the thermal measurements is described. The autoreduction of AmO_2^+ and AmO_2^{2+} and the disproportionation of AmO_2^+ have been investigated. (auth)

Refer also to abstract 5784.

URANIUM AND URANIUM COMPOUNDS

5824 AERE-C/M-258

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

ORGANO-URANIUM COMPOUNDS. Alan E. Comyns. Sept. 1955. 9p.

Unsuccessful attempts to prepare compounds with uranium–carbon bonds (other than carbides) are described, and available information on such compounds is reviewed. Neither alkyls, aryls, nor carbonyls are known; but a double cyanide and two cyclopentadienyl compounds, all of uncertain structure, have been isolated by other workers. (auth)

5825 BMI-1175

Battelle Memorial Inst., Columbus, Ohio.

EXPERIMENTS ON THE PREPARATION OF UO_{2-x} AND UO. Dale A. Vaughan, Carl W. Melton, and Arnold F. Gerds. Mar. 6, 1957. 12p. Contract W-7405-eng-92. $0.15(OTS).

Reactions designed to reduce the O_2 content of UO_2 below stoichiometric composition are described. No evidence was found for the existence of substoichiometric UO_2. The reaction of metal with UO_{2+x} yields a phase described in the literature as uranium monoxide, UO. However, the reaction proceeds at a low rate and the reaction products are contaminated with a large amount of UO_2. The reaction of UC with UO_2 is described: this reaction is capable of producing a single-phase material of composition UC_xO_{1-x}($x \cong 0.5$) by heating in vacuum at 1600 to 1800°C. (auth)

Refer also to abstracts 5783 and 5795.

WASTE DISPOSAL

5826 AECU-3370

Oak Ridge National Lab., Tenn. and Burns and McDonnell Engineering Co., Kansas City, Mo.

PROCESS WASTE WATER TREATMENT PLANT. Preliminary Report. Feb. 1957. 52p. Contract W-7405-eng-26 and AT(40-1)-2008. $0.45(OTS).

A proposal is presented for the construction, at a cost of $180,000, of a plant to treat the low level radioactive liquid waste from the various laboratory processes. The proposed plant will reduce the radiation activity of that waste to a level that will not exceed the accepted standards for discharges into White Oak Creek and the Clinch River. (auth)

5827 CRCE-591

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

ULTIMATE FISSION PRODUCT DISPOSAL. THE DISPOSAL OF CURIE QUANTITIES OF FISSION PRODUCTS IN SILICEOUS MATERIALS. J. M. White and G. Lahaie. Mar. 1955. 34p.

Several proposed methods of permanent disposal are

discussed. The fusion of fission products with siliceous materials is one method which might satisfy disposal requirements. Of the siliceous materials investigated nepheline syenite approaches closely the requirements of an ideal glass forming silicate. This silicate can be mixed directly with HNO_3–fission products wastes to form a solid gel. The gel on drying and heating to about 1225°C forms a glass containing the fission products. The only isotope which is volatile to any extent is Ru. Some commercially produced glasses, glazes, or enamel frits may combine with fission products to form insoluble glasses but the cost will be greater than that of nepheline syenite. (auth)

5828 HW-47896

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

A RADIOCHEMICAL SEPARATION FOR COBALT-60 IN AQUEOUS WASTE SOLUTIONS. R. A. Schneider. Jan. 1, 1957. 26p. Contract W-31-109-Eng-52. $0.25(OTS).

Several methods of chemically separating Co^{60} from aqueous waste solutions and interfering nuclides were investigated. In the most suitable method, Co^{60} is carried from solution as a mixture of insoluble cobaltous and ferrous cobalticyanides after the cobaltic ammine complexes have been destroyed by reduction and acid deammoniation. Removal from solution is approximately 99.9% complete. An average radiochemical yield of 98.1% is obtained for the complete separation procedure. The procedure involves no precise techniques or exacting measurements, and has been adopted for routine use. (auth)

5829 WASH-734

Division of Reactor Development. Engineering Development Branch, AEC.

UNITED STATES' SEA DISPOSAL OPERATIONS. A SUMMARY TO DECEMBER 1956. Arnold B. Joseph. 16p. $3.30(ph OTS); $2.40(mf OTS).

Some atomic energy activities in the United States have been disposing of radioactive wastes at selected ocean disposal sites since as early as 1946. It is the purpose of this report to describe the extent of these disposal operations including a summary of types of packaging used, and of places where the wastes are dumped. The status of related oceanographic research (1956) is briefly touched upon. (auth)

Refer also to abstract 6001.

ENGINEERING

5830 AECU-3417

Dow Chemical Co. Rocky Flats Plant, Denver.

EXTENSION OF USEFUL LIFE OF EXHAUST AIR FILTERS AFTER AMMONIUM NITRATE LOADING. R. P. Craig, P. D. Erickson, J. A. Geer, and F. J. Linck, Jr. Oct. 1956. 24p. Contract AT(29-1)-1106.

Air filters were found to be plugging with NH_4NO_3. The useful life of these filters was increased 4 times by occasional humidification with steam. (T.R.H.)

5831 CF-57-4-17

Oak Ridge National Lab., Tenn.

SUGGESTION FOR HIGH PRESSURE LETDOWN DEVICE. R. N. Lyon. Apr. 2, 1957. 4p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A letdown valve design is described which reduces erosion of the sealing surfaces. It also provides for water flushing of the sealing surfaces before closing. (T.R.H.)

5832

PROGRESS IN NUCLEAR ENERGY. SERIES IV. TECHNOLOGY AND ENGINEERING. R. Hurst and S. McLain, eds. New York, McGraw-Hill Book Co., Inc., 1956. 432p.

Methods of producing and purifying such reactor materials as D_2O, graphite, BeO, Na, and NaK alloys are reviewed, and the efficiencies of the various methods are discussed. Many of the problems associated with reactor cooling and heat transfer are considered; specific treatment being given to the cases of boiling and liquid metal heat transfer. Coolant pump requirements and development are noted. Papers are included which treat specific chemical and corrosion problems in both heterogeneous and homogeneous, and water and metal cooled reactors. (D.E.B.)

HEAT TRANSFER AND FLUID FLOW

5833 AECU-3473

Sandia Corp., Albuquerque, N. Mex.

SUBCRITICAL AND CRITICAL FLOW THROUGH STRAIGHT-THROUGH, ELBOW, AND TEE "AN" FITTINGS AND SHARP-EDGED ORIFICES AT ELEVATED TEMPERATURES. Arnold L. Ducoffe, John R. Bennett, and C. Gable Ray. Mar. 6, 1957. 31p. Contract AT(29-1)789. (TM-34-57-51). $4.80(ph OTS); $2.70 (mf OTS).

An investigation of the flow through straight-through, elbow, and tee "AN" fittings at negligible approach velocity with approach temperatures up to 1100°F is presented. The pressure ratio across the test element was varied between 1.0 and approximately 0.15. Empirical equations for the subcritical and critical flow regimes are derived for the rate of weight flow as a function of element pressure ratio, flow area, and approach temperature and pressure. Empirical equations for a given geometry are derived for a flow factor which is shown to be a function of pressure ratio only in both the subcritical and critical regions. In addition previous work at room temperature on the flow through sharp-edged orifices in the subcritical and critical regimes have been extended to include a variation of approach temperature up to 1100°F. (auth)

5834 BMI-1116

Battelle Memorial Inst., Columbus, Ohio.

HEAT TRANSFER AND BURNOUT TO WATER AT HIGH SUBCRITICAL PRESSURES. Harold M. Epstein, Joel W. Chastain, and Sherwood L. Fawcett. July 20, 1956. 28p. Contract NObs-65057.

Local surface coefficients of heat transfer and burnout heat fluxes are presented for deionized water flowing upward in a vertical Hastelloy C tube under the following conditions: mass velocity in the range 1.5×10^6 to 3×10^6 lb/(hr)(ft^2) pressure from 1500 to 2750 psia, and Reynolds numbers in the neighborhood of 10^5. The heat-transfer data are correlated with the Colburn equation. The burnout heat-flux data could not be satisfactorily correlated with the Jens and Lottes relation. Burnout results at the $L/d = 80$ showed a strong dependence upon the amount of inlet subcooling. All burnout heat fluxes appeared to be linearly dependent upon mass flow rate. (auth)

5835 NDA-22

Nuclear Development Corp. of America, White Plains, N. Y.

BOILING BURNOUT PROGRESS. [Issue] No. 7. Unclassified Section. (15J-11). John E. Viscardi, ed. Nov. 7, 1955. 12p. Contract AT(30-1)-862. $3.30(ph OTS); $2.40(mf OTS).

Studies are reported in boiling burnout with simulated fuel elements, heat transfer to binary liquid mixtures, accurate determination of heat transfer to boiling H_2O–$CH_3COC_2H_5$ mixtures, and definition of terms related to boiling heat transfer. (T.R.H.)

5836 NDA-28

Nuclear Development Corp. of America, White Plains, N. Y.

REACTOR HEAT TRANSFER PROGRESS. [Issue] No. 10. Unclassified Section. (15J-14). John E. Viscardi, ed. July 10, 1956. Includes Translation: CHARACTERISTICS OF MERCURY BOILING IN THE TUBES OF A MERCURY–VAPOR GENERATOR. A. N. Loshkin and P. I. Krol'. Translated by John E. Viscardi from Zhur. Tekh. Fiz. 8, 1872-81(1938). 26p. Contract AT(30-1)-862. $4.80(ph OTS); $2.70(mf OTS).

There is no Classified Section of Issue No. 10.

Some preliminary results of studies on heat transfer in polyphenyls are given. A transition state theory of the linear oxidation rates of metals is offered. A translation of an article on "Characteristics of Mercury Boiling in the Tubes of a Mercury–Vapor Generator" is included in part. (For preceding period see NDA-26.) (T.R.H.)

5837 NDA-33

Nuclear Development Corp. of America, White Plains, N. Y.

REACTOR HEAT TRANSFER PROGRESS. [Issue] No. 13. Unclassified Section. (2008-18). John E. Viscardi, ed. Feb. 14, 1957. 27p. Contract AT(30-1)-862. $4.80(ph OTS); $2.70(mf OTS).

Heat transfer studies with turbulent gas flow in plane annular passages are reported. Heat transfer performance and physical properties of molten alkali metals are investigated. (For preceding period see NDA-30.) (T.R.H.)

5838 NURG/M-18

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DISTRIBUTION OF WALL FRICTION OVER LONGITUDINAL FINS. O. Pulley. Mar. 19, 1952. Decl. Nov. 22, 1956. 18p.

Complete results are given of the calculations, by the relaxation method, of the distribution of shear stress in finned annuli. The salient feature is the high shear stress at the fin tips. It is inferred that heat is removed mainly from this region and that the assumption that all heat is removed via the tips is preferable to that of uniform removal over the whole fin surface. (auth)

5839 NURG/M-22

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

CRITICAL SURVEY OF CHANNEL COOLING. O. Pulley. June 26, 1952. Decl. Nov. 21, 1956. 46p.

A detailed study was made of the corrections to theory required to give adequate accuracy for the design and performance of a single gas-cooled channel. For the most part, the corrections are unimportant in a natural U, graphite moderated pile with Al or Mg finning. Actual velocity, output and metal rating are almost, and the relative pressure drop completely, independent of the finning arrangements. The relative pressure drop is always small and the useful velocity is restricted to a range of less than 4 to 1. Conventional fin designs fix an upper limit to the outlet coolant temperature which is below that giving maximum output. The four coolants, air, CO_2, He and H are compared and an important difference found only in the case of H. (auth)

5840 WADC-TR-55-422(Pt. I)

Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.

REVIEW OF THE LITERATURE ON TWO-PHASE (GAS–LIQUID) FLUID FLOW IN PIPES. PART I. William A. Gresham, Jr., Perry A. Foster, Jr., and Robert J. Kyle. June 1955. 157p. Project title: FUEL AND PROPELLANT SUB SYSTEMS. Contract AF33(616)-2660. (AD-95752).

5841 USNRDL-TR-131

Naval Radiological Defense Lab., San Francisco.

CONSTANT FLOW-RATE DEVICE FOR ELECTROLYTE ELUANTS IN COLUMN CHROMATOGRAPHY. R. K. Main, L. J. Cole, L. M. Bryant, and S. K. Morris. Jan. 15, 1957. 11p. Project NM 006-015.

A device is reported which was designed for the accurate control of the flow of an electrolyte eluant through a chromatographic column. This device, operating on the principle of volume delivery, offers certain advantages over those control devices based on the principle of capillary throttle. It has been utilized successfully in laboratory studies on fractionation of nucleic acids by column chromatography. (auth)

5842

VOID FRACTIONS IN TWO-PHASE STEAM–WATER FLOW. H. S. Isbin, Neil C. Sher, and K. C. Eddy (Univ. of Minnesota, Minneapolis). A.I.Ch.E. Journal 3, 136-42(1957) Mar.

Void fractions and pressure drops for steam-water flows were measured in an 0.872-in. I.D. vertical tube at atmospheric pressure over a quality range of 0 to 4%. The test section was the hot leg of a natural-circulation loop, and the inlet liquid flow rate ranged from 1 to 3 ft./sec. A new technique for measuring void fractions was used, and the method utilizes the difference between the gamma-ray absorption coefficients of water and steam. (auth)

5843

HYDRODYNAMICS OF A REACTING AND RELAXING FLUID. William W. Wood (Los Alamos Scientific Lab., N. Mex.) and John G. Kirkwood (Yale Univ., New Haven, Conn.). J. Appl. Phys. 28, 395-8(1957) Apr.

General equations governing the hydrodynamic behavior of an ideal compressible fluid in which chemical reactions and internal relaxations proceed are formulated. For one-dimensional flow the equations are transformed to characteristic form, in which the "frozen" or high-frequency sound velocity plays a role analogous to the unambiguous sound velocity in the nonreactive case. (auth)

5844

DIPHENYL AS A THERMODYNAMIC FLUID. D. C. Purdy (Chrysler Corp., Ann Arbor, Mich.). Nucleonics 15, No. 4, 109-12(1957) Apr.

An investigation of the use of diphenyl as the working fluid in a heat engine is presented. (W.L.H.)

MATERIALS TESTING

5845 AECU-3433

Knolls Atomic Power Lab., Schenectady, N. Y.

LEAK TESTING PROCEDURE. C. F. Barrett, Jr. Nov. 19, 1953. 4p. Contract [W-31-109-Eng-52]. (KAPL-O-KPMO-6(Rev.3)). $1.80(ph OTS); $1.80(mf OTS).

A leak testing procedure is presented that covers the requirements for leak testing of pipe, tube, and finished equipment. (W.L.H.)

5846 WAPD-TM-37

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

MECHANICAL LOADING VERSUS THERMAL LOADING. R. P. Kapp. Jan. 21, 1957. 6p. Contract AT-11-1-GEN-14. $1.80(ph OTS); $1.80(mf OTS).

While the evaluation of mechanically applied loads on a stress basis is realistic, the evaluation of thermal loads

on this basis is shown to be extremely conservative. Evaluation of thermal loading on the basis of strain measurements is proposed. (D.E.B.)

5847

INSPECTION OF SMALL-DIAMETER TUBING BY EDDY-CURRENT METHODS. J. W. Allen and R. B. Oliver (Oak Ridge National Lab., Tenn.). Non-Destructive Testing 15, 104-9(1957) Mar.-Apr.

A report is presented on what can be accomplished with eddy-current tests on nonferromagnetic small diameter tubing according to present methods. A brief review of eddy-current testing in general is reported. (auth)

PUMPS

5848 HW-47799

General Electric Co. [Hanford Atomic Products Operation], Richland, Wash.

ALTERNATE PROCESS WATER BY-PASS SYSTEMS FOR CG-558 PUMPS. William J. Love. Dec. 20, 1956. 25p. $4.80(ph OTS); $2.70(mf OTS).

A report of engineering services performed under Consultant Agreement No. CA-150.

The analysis and test data for the three nozzle by-pass are presented, and the results of the study of alternate designs which would permit high head loss without cavitation are reported. (auth)

5849 LMFS/P-11

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EFFECTS OF A CAVITATION LIMIT ON THE DESIGN OF PUMPS FOR LIQUID BISMUTH. S. B. Hosegood. Jan. 11, 1957. 22p.

The restrictions imposed on the design of various types of pump by the assumption of a cavitation parameter limit were examined. It is shown that such a limit severely restricts the pressure ratio obtainable from a single axial stage. The pressure ratio obtainable from a centrifugal pump is theoretically not restricted by a cavitation parameter less than three, but a practical limit is imposed by the size of impeller required to produce large pressure ratios. The cavitation limit does not restrict the pressure ratio of an electromagnetic pump, but it limits the liquid velocity which can be employed in the working duct with a given suction pressure. (auth)

RADIOGRAPHY

5850

AN EVALUATION OF THE APPLICATION OF THULIUM-170 TO INDUSTRIAL RADIOGRAPHY. James W. Dutli and Dana E. Elliott (Los Alamos Scientific Lab., N. Mex.). Non-Destructive Testing 15, 112-14(1957) Mar.-Apr.

A portable x-ray unit utilizing the isotope Tm^{170}, has been evaluated experimentally for its application to industrial radiography. Radiographic-exposure techniques, resolutions, and sensitivities for Mg, Al, steel, and plastic are presented. The results of an experimental determination of the spectrum emanating from the unit are also included. It is concluded that Tm^{170} is suitable for radiography of very thin metal sections. The light weight and the compactness of the unit should make it applicable in many cases where x-ray generators cannot be used because of space limitations or economy. (auth)

WASTE DISPOSAL

5851

HEAT-CONDUCTION LOSSES IN REACTOR WASTE BASINS. Stanley H. Jury (Univ. of Tennessee, Knoxville). A.I.Ch.E. Journal 3, 143, 9M(1957) Mar.

The problem of heat loss from the bottom of an asphalt-lined waste disposal pit is considered. It is concluded that this heat loss is negligible compared to the rate of radio heat generation. The pool would have to be filled with insulation to prevent softening of the asphalt liner. (T.R.H.)

5852

TANKS FOR 1000 YEARS: DESIGN CONSIDERATIONS OF STORAGE TANKS FOR RADIOACTIVE WASTE. Edgar E. Wilson. Chem. Eng. Progr. 53, 151M-2M(1957) Mar.

MINERALOGY, METALLURGY, AND CERAMICS

5853 WADC-TR-54-98(Pt.3)

Connecticut Hard Rubber Co., New Haven.

INVESTIGATION AND DEVELOPMENT OF HIGH-TEMPERATURE STRUCTURAL ADHESIVES. Report No. 3 [for] May 1, 1955 to November 1, 1955. Alfred S. Kidwell and Kenneth L. McHugh. Sept. 1956. 74p. Project title: JET ROTORS. Task title: HEAT RESISTANT ADHESIVES. Contract AF33(616)-2448. (AD-97287).

Wide variations in the composition of the CHR-M-60 epoxy-modified DC-2103 silicone resin with Asbestine X filler, which has shown shear strength values as a metal-to-metal adhesive in excess of 1000 psi at 500°F, have been made and the results plotted to indicate composition areas yielding maximum shear strength values. Extended high-temperature aging tests have shown DC-803 silicone resin and epoxy-modified DC-803 to have better aging resistance than DC-2103 and epoxy-modified DC-2103, respectively. The DC-803 showed little loss in shear strength at 500°F after aging 1200 hr at 500°F on both Al panels and stainless steel panels (residual shear strength about 300 psi at 500°F). This resin also withstood 300 hr at 600°F on stainless steel and 200 hr on Al. The 20% epoxy-modified DC-803 lasted 800 hr at 500°F and 100 hr at 600°F (residual strength in each case about 350 psi at room temperature and 150 psi at 500°F). A number of silicone-epoxy-phenolic resin blends were prepared, which showed shear strength values and high-temperature aging resistance slightly better than those for the epoxy-modified silicone resins. Up to 20% of epoxy resin in epoxy-modified DC-2103 silicone resin was found to have relatively little effect on the change in shear strength values when tested over a temperature range from −70 to +900°F; the opoxy resin mainly improved the strength over the lower half of the temperature range. Shear strength at 900°F was about 100 psi. (auth)

5854 RAE-Lib/Trans-576

STATISTICAL INTERPRETATION OF FATIGUE TESTS. (L'interpretazione Statistica Delle Prove di Fatice). F. Gatto. Translated by R. C. Murray from Alluminio 24, 543-54(1955). 17p. (AD-104424).

A review of the more important of the methods which have been published for the statistical analysis of fatigue data, with proposal of two new methods: that of the mobile mean, and of rearrangement of data, each illustrated by examples. (auth)

CERAMICS AND REFRACTORIES

5855 56-RL-1606

General Electric Co. Research Lab., Schenectady, N. Y.

MICROSTRUCTURE OF BARIUM TITANATE CERAMICS.

R. C. DeVries and J. E. Burke. Aug. 1956. 30p.

The microstructure of polycrystalline barium titanate as seen in polished and etched specimens is more complicated than that in the single crystal. The greater complexity is revealed in the form of a banded structure which is considered to be due to the stress configuration arising from mutual impingement of randomly oriented grains during the cubic-tetragonal phase transformation. (auth)

5856 BMI-1165

Battelle Memorial Inst., Columbus, Ohio.

PROPERTIES OF BERYLLIUM OXIDE AND CARBIDES OF BERYLLIUM, MOLYBDENUM, NIOBIUM, TANTALUM, AND TITANIUM. William P. Weber, John F. Quirk, Alexis W. Lemmon, Jr., and Robert B. Filbert, Jr. Feb. 11, 1957. 41p. Contract W-7405-eng-92. $0.35(OTS).

5857 JPL-PR-20-252

California Inst. of Tech., Pasadena. Jet Propulsion Lab.

STABILITY OF TITANIUM DIBORIDE AND ZIRCONIUM DIBORIDE IN AIR, OXYGEN, AND NITROGEN. Frank H. Brown, Jr. Feb. 25, 1955. 16p. Contract DA-04-495-Ord-18.

Compressed specimens of TiB_2 and ZrB_2 powders were studied at temperatures between 900 and 2400°F in air, N_2, and O_2. X-ray-diffraction methods were used to analyze those structures which exist after the treatments in order to determine the effects of the three gases on the two materials. (auth)

5858 OSR-TN-56-446

Illinois. Univ., Urbana.

THE POLYMORPHIC MODIFICATIONS OF SILICA IN CERAMIC COATINGS. Report No. 77. J. H. Lauchner. Feb. 1957. 23p. Contract AF18(603)-28. (AD-96791).

The polymorphic modifications of silica present in ceramic coatings due to devitrification or as a result of direct additions were identified by thermal strain, x-ray diffraction and differential thermal analyses. Comparison of the analytical results indicated thermal strain analysis to be the most sensitive method in identification of all silica modifications studied. Analysis of the tessellated stresses developed in the systems was applied in determination of effective linear thermal expansion characteristics and interpretation of residual stress development. (auth)

CORROSION

5859 AECU-3388

Oregon. Univ., Eugene.

THE ANODIC OXIDATION OF SOME DILUTE BINARY ZIRCONIUM ALLOYS. George B. Adams, Jr., Curtis E. Borchers, and Pierre Van Rysselberghe. Jan. 1, 1957. 29p. Contract [AT(45-1)-535]. $0.25(OTS).

The low-potential anodic oxidation of Kroll process Zr at very small constant ionic currents in aqueous media was described. The apparent electrolytic parameters σA_+, σB_+, the apparent formation field, F/σ, and estimates of local corrosion currents and oxide film thicknesses were all obtained from potential-time measurements on the very thin anodic oxide films formed in the potential range below O_2 evolution. The present research is an attempt to correlate changes in these measured electrolytic parameters for the anodic oxidation process with changes in alloying constituents for a series of dilute binary Zr alloys. (auth)

5860 NBTL-P-243

Naval Boiler and Turbine Lab., Philadelphia.

HIGH TEMPERATURE CORROSION. A RESEARCH AND DEVELOPMENT TEST. Interim Report No. 3 [for] April to October 1954. Hormann Meyer. Jan. 19, 1955. 55p. (AD-76707).

Research was conducted to evaluate the effects of Na in the presence of V, S, Mg, $PhNH_2$, and excess air, individually and collectively, on corrosion of certain alloys under actual combustion conditions at elevated temperatures and to compare them with the effects obtained by the addition of V. The effects of Na, added to a boiler fuel in the form of Na oleate, on the corroding tendencies of 5 stainless steel alloys were determined by exposure to diverse elevated temperatures. Corrosive conditions were produced in a furnace by burning diesel fuel with 3 Na contents, employing 2 V, 2 S, and 2 excess air percentages as well as 1 Mg and 1 $PhNH_2$ concentration. Eighteen 30-hr runs were conducted. A scale was formed in the majority of cases; slag formed only when Mg was present at lower temperatures. Na was a corrodent agent at elevated temperatures. O and Mg retarded, while S and $PhNH_2$ augmented corrosion caused by Na as well as that by combined Na and V. A general diagram for Na and V corrosion is included. (auth)

5861 WADC-TR-56-237

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

EVALUATION OF THIN IRON FILMS AS SENSITIVE CORROSION INDICATORS. [Period Covered:] January 1955 to April 1956. David Roller. June 25, 1956. 37p. Project title: FINISHES AND MATERIALS PRESERVATION. Task title: CORROSION AND CORROSION PREVENTION. (AD-107256).

A preliminary evaluation of the corrosion rates of thin, continuous, adherent vacuum deposited Fe films in various humidities to determine their suitability as corrosion indicators is described. Variables investigated included film thickness and film substrate as it affected the corrosion rates in various humidities. It was evident from this work that thin pure Fe films corrode readily in high static humidities. Recommendations for further investigations needed to develop a suitable visual or electrical indicator for use in packages are made. (auth)

5862

MECHANISMS OF AQUEOUS CORROSION OF ALUMINUM AT 100°C. K. M. Carlsen (Joint Establishment for Nuclear Energy Research, Lillestrom, Norway). J. Electrochem. Soc. 104, 147-54(1957) March.

Various alloys of Al, as well as superpurity Al material, have been tested in aqueous solutions at 100°C. Samples have been polarized cathodically and anodically to study the effect of cathodic and anodic reactions, respectively, on the corrosion behavior. Results are interpreted as showing that the alkalinity produced at the cathodes facilitates film breakdown in these places. Consequently, alloys containing cathodic constituents were attacked where these constituents were situated, while polycrystalline superpurity material was attacked in the grain boundaries. The influence of bulk pH and inhibitors is discussed in some detail. (auth)

GEOLOGY AND MINERALOGY

5863

MINERALOGY OF THE LONE EAGLE URANIUM-BEARING MINE IN THE BOULDER BATHOLITH, MONTANA. H. D. Wright and W. P. Shulhof (Pennsylvania State Univ., University Park). Econ. Geol. 52, 115-31(1957) Mar.-Apr.

The Lone Eagle mine is the only producing U deposit among the "base metal" veins in the Boulder batholith, Mont. Steeply dipping fracture fillings in quartz monzonite contain sparsely distributed pitchblende, together with

pyrite, sphalerite, galena, and minor chalcopyrite and argentite in a gangue of quartz, calcite and siderite. Deposition of coarsely crystallized quartz and the sulfides was followed by extensive brecciation prior to the introduction of microcrystalline quartz pitchblende, and minor fine-grained sulfides. The latter assemblage strongly resembles the "siliceous reef" U deposits in the batholith. Of the three varieties of pitchblende recognized, only one appears to represent primary introduction of U. Detailed data were obtained on the pitchblende varieties and an unusual, fine-grained galena associated with pitchblende. Study of the wall rock provided detailed information on the nature and composition of the feldspars, the percentage mineral composition and texture of the rock, and its chemical composition. The rock may be classified petrographically as a peraluminous granodiorite or an adamellite. The alteration halo, extending as much as 30 ft from the vein, has a mineral assemblage—sericite, kaolinite, montmorillonite, chlorite, quartz, calcite, siderite, and pyrite—similar to that associated with the "siliceous reefs" and to the Butte alteration. Of the plutonic minerals, only quartz, apatite, and zircon are found adjacent to the vein. Study of the alteration zoning was inhibited by the lack of adequate samples more than a few feet from the vein. (auth)

5864

APPLICATION OF PUNCHED CARDS TO GEOLOGIC DATA CONCERNING URANIUM DEPOSITS IN SANDSTONE. W. I. Finch (U. S. Geological Survey, Denver, Colo.). Econ. Geol. 52, 180-91(1957) Mar.-Apr.

The punched card has been chosen for use in compiling the great mass of geologic data concerning uranium deposits in sandstone into permanent file. The most valuable uses of the punched-card file are as a multiple index to data and as a means of correlating different data. By using the punched card, uranium deposits in sandstone can also be compared to other metalliferous deposits in sandstone. Besides the geographic location of the deposit, about 120 different items can be punched on the sides of the card. In the center of the card more detailed data and a summary of the report are given. Although the card is designed for data on a single deposit or group of deposits, topical data on many studies such as chemistry, geobotanical prospecting, and geophysics can be summarized on the card. (auth)

5865

SYSTEMATIC VARIATION OF RARE-EARTH ELEMENTS IN CERIUM-EARTH MINERALS. K. J. Murata, H. J. Rose, Jr., M. K. Carron, and J. J. Glass (U. S. Geological Survey, Washington). Geochim. et Cosmochim. Acta 11, 141-61 (1957) Mar.

Rare-earth elements and Th have been determined in monazite, allanite, cerite, bastnaesite, and a number of miscellaneous Ce-earth minerals. A quantity called sigma (Σ), which is the sum of the atomic percentages of La, Ce, and Pr, is proposed as an index of composition of all Ce-earth minerals with respect to the rare-earth elements. The value of Σ for all of the minerals analyzed falls between 58 and 92 at. %. Monazites, allanites, and cerites cover the entire observed range, whereas bastnaesites are sharply restricted to the range between 80 and 92 at. %. The minimum value of Σ for a Ce-earth mineral corresponds to the smallest possible unit-cell size of the mineral. In monazite, this structurally controlled minimum value of Σ is estimated to be around 30 at. %. Neodymium, because of its abundance, and Y, because of its small size, have dominant roles in contraction of the structure. In the other direction, the limit of variation in composition will be reached when La becomes the sole rare-earth element in a Ce-earth mineral. Cerium-earth minerals from alkalic rocks are all characterized by values of Σ greater than 80 at. %, indicating that the processes that formed these rocks were unusually efficient in fractionating the rare-earth elements—efficient in the sense that a highly selected assemblage is produced without eliminating the bulk of these elements. Analyses of inner and outer parts of two large crystals of monazite from different deposits show no difference in Σ in one crystal and a slightly smaller value of Σ in the outer part of the other crystal compared to the inner part. The Σ of monazites from pegmatites that intrude genetically related granitic rocks in N. C. is found to be either higher or lower than the Σ of monazites in the intruded host rock. These results indicate that the fractionation of the rare-earth elements is not a simple unidirectional process. When a Ce-earth mineral undergoes replacement, its rare-earth elements may be fractionated into two parts, one forming a new mineral with Σ that is smaller, and the other a second new mineral with Σ that is larger than that of the original mineral. The complete analysis of a Ce-earth mineral to determine its Σ is time consuming. The discovery of a direct relationship between Σ and the Ce/(Nd + Y) atomic ratio in Ce earth minerals allows a rapid determination of Σ from spectrograms obtained in a previously described method for determining Th in these minerals. (auth)

5866

PHOTOGRAPHIC STUDY OF THE DISTRIBUTION OF THE RADIOACTIVITY IN THE GRANODIORITE OF ADAMELLO. O. Hieke Merlin, E. Picciotto, and S. Wilgain. Geochim. et Cosmochim. Acta 11, 171-88(1957) Mar. (In French)

5867

COMPARISON OF THE ISOTOPIC ABUNDANCE OF U^{235} AND U^{238} AND THE RADIUM ACTIVITY RATIOS IN COLORADO PLATEAU URANIUM ORES. F. E. Senftle, Lorin Stieff, Frank Cuttitta, and P. K. Kuroda (U. S. Geological Survey, Washington). Geochim. et Cosmochim. Acta 11, 189-93(1957) Mar.

The isotopic abundances of U and the Ra activity ratios of eleven samples of U ore from the Colorado Plateau have been measured. No significant variation in the isotopic abundance of the U was noted; within the experimental error, the average U^{235}/U^{238} ratio is 137.7. There is a significant variation in the Ra^{226}/Ra^{223} activity ratios (0.048–0.143), which indicates a relatively recent alteration of the ore samples. The variations do not, however, explain the Pb–U and Pb–Pb age discrepancies. (auth)

5868

PHOTOGEOLOGIC MAP OF THE LEES FERRY NW QUADRANGLE, COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-196. Kathleen McQueen. Washington, U. S. Geological Survey, 1957. $0.50.

5869

PHOTOGEOLOGIC MAP OF THE NAVAJO MOUNTAIN-8 QUADRANGLE SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-221. A. B. Olson. Washington, U. S. Geological Survey, 1957. $0.50.

5870

PHYSICAL STRATIGRAPHY OF THE PHOSPHORIA FORMATION IN NORTHWESTERN WYOMING. Richard P. Sheldon. U. S. Geol. Survey Bull. 1042-E 1957. 87p. and illus.

The sediments of the Phosphoria formation were deposited in a basin in northwestern Wyoming which sheived gently eastward and northward. Detritus was derived from a low land area in southwestern Montana and from another low land area many miles to the east of northwestern Wyoming. Cold sea water, rich in phosphorus and CO_2 welled up over the shelf areas with a consequent change in the

physical-chemical character of the water, the most important changes being a landward increase in alkalinity and redox potential. The type of sediment reflected the change in physical-chemical environment: the pelletal, oolitic, and nodular phosphorite was deposited under conditions of low pH and Eh values; chert, of intermediate values; and carbonate rock, of high values. Of the minor constituents of the sediments, organic matter and pyrite are associated with the phosphorite and some of the chert; glauconite, with the rest of the chert and some of the carbonate rock; and hematite, with the carbonate rock in the red bed facies in northwestern Wyoming. Sand was deposited with the carbonate rock and some of the chert, and mud was deposited with the rest of the chert and the phosphorite. Owing to tectonic movements, these environments transgressed and regressed twice across northwestern Wyoming, producing an interfingering of the different rock types. The vertical sequence of rocks is cyclic because of the alternation of environments. The tectonic movements, as recorded by the rocks, were pulsatory: the downward movement rapid and the upward movement slow. Northwestern Wyoming, where the pulsatory movements were active, was the unstable shelf. At the east, in central Wyoming, lay the stable shelf, where tectonic movements were minor. At the west, in Idaho, lay the miogeosyncline, which in Permian time was a negative area, relatively unaffected by the upward tectonic movements. (auth)

METALS AND METALLURGY

5871 AD-103599
Ohio State Univ. Research Foundation, Columbus.
RESEARCH ON PHASE RELATIONSHIPS IN TERNARY METAL–METAL–OXYGEN SYSTEMS. Quarterly Report No. 3 [for] April 1, 1956–June 30, 1956. E. Mack. June 30, 1956. 15p. RF Project 657. Contract AF33(616)-3189.

Studies in the region Ti–Zr–ZrO_2–TiO using x-ray-diffraction patterns at 1500°C are continued. The region TiO–TiO_2–ZrO_2 is studied by x-ray diffraction on quenched complexes. (T.R.H.)

5872 AD-105100
Library of Congress. Technical Information Div., Washington, D. C.
THERMAL PROPERTIES OF CERTAIN METALS. (Abstract Bulletin TP11). Apr. 20, 1956. 14p. Contract AF 33(616)55-10.

5873 AECU-3174
Martin (Glenn L.) Co., Baltimore.
SPECIAL WELDING TECHNIQUES. Final Summary Report for 1954. Jan. 31, 1955. 48p. For Oak Ridge National Lab. Contract W-7405-eng-26, Sub-contract No. 588. (ER-6351). $0.35(OTS).

The successful development of methods for the resistance welding of heat exchanger tube-to-headers is presented. The techniques developed have proven practical for the fabrication of representative heat exchanger configurations in accordance with the unusual specifications required for nuclear power applications. The flange-during-welding method was developed to consistently produce high-quality recrystallization welds. With the recrystallization method it is possible to weld reliable and reproducible joints of high strength which will not leak. A method in which preflanged tubes were welded to drilled headers was also found to give high-strength, leakproof connections. Using these methods for the fabrication of tube clusters, brazing was not found necessary for the sealing of leaks. However, brazing should have a beneficial effect on the corrosion and fatigue resistance of the joint. Satisfactory methods were developed. Underwater welding, fabrication of electrodes, including those for cluster-support blocks, and tube bending and flaring required special tooling which was developed. Examination and tests of welded tube-to header joints and actual clusters established that hydrostatic pressure testing to failure was the most satisfactory way of determining the strength of the weld joint. Cycle testing to simulate service conditions, followed by helium leak detection, is recommended as a non-destructive acceptance test. Metallographic examination of the interface at high magnifications was sometimes necessary to distinguish between recrystallization bonding and mere contact. (auth)

5874 AECU-3424
Case Inst. of Tech., Cleveland.
AN INVESTIGATION OF SCALING OF ZIRCONIUM AT ELEVATED TEMPERATURES. Quarterly Status Report No. 15 [for] December 2, 1956 to March 2, 1957. H. B. Probst, E. B. Evans, and W. M. Baldwin, Jr. Mar. 6, 1957. 7p. Contract AT(11-1)-258. $1.80(ph OTS); $1.80(mf OTS).

5875 AECU-3431
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
THE FEASIBILITY OF ROLL CLADDING TITANIUM ON STEEL. Summary Report [for] November 1, 1955 to December 31, 1956. R. F. Domagala and David W. Levinson. Dec. 31, 1956. 71p. Project B 092. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract No. 862. $12.30(ph OTS); $4.50(mf OTS).

The feasibility of roll cladding Ti on steel, using an intermediate diffusion barrier layer of V was investigated. The results of this program indicate that Ti may be successfully roll clad on plain C steel. Reductions of the order of 80% or more are required; rolling temperatures may be from ~850 to 1000°C. The strength of such clads are substantial. Rather severe bends are possible; the quality of the bond as determined by bend testing is not seriously affected by protracted anneals at from 300 to 750°C. A phase at the V–steel interface was detected. Very probably sign sigma, this phase does not seem to be a serious threat to the stability of the clad. A thin layer of pure Cu interposed between the V and the plain C steel base has proved effective in providing some improvement in the quality of the clad. Smaller reductions to cause bonding are necessary, and no interface phase develops at any point in the composite. Titanium may be clad on stainless steel, using procedures much the same as those employed for plain C steel clads. The quality of such clads is not as good as the plain C steel base counterpart, even when a pure Cu layer is placed between the V and the stainless steel. Although the stainless steel–V–Ti clads leave something to be desired, such clads are sound and are sure to be satisfactory for many applications. (auth)

5876 AERE-M/M-56
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE PRODUCTION OF SINGLE CRYSTALS OF ALPHA BRASS IN WIRE FORM. N. A. McKinnon. [1952?]. 4p.

The preparation of single crystal wires 1 mm diameter and 25 cm long of 70/30 alpha brass was attempted by a number of methods. A technique of local melting and cooling in a temperature gradient of 50 to 55°C/cm at a speed of 1.5 cm/hour has proved successful. The technique was also applied to the production of 75/25 alpha brass crystals. (auth)

5877 AERE-M/R-1442
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE SINTERING OF BERYLLIUM POWDER PREPARED

FROM ELECTROLYTIC FLAKE. A. Blainey, T. L. Johnston, and J. W. S. Jones. May 28, 1954. 35p.

The production of Be powder from electrolytic Be flake by direct crushing, and melting, casting and crushing, is described. In the first method details of chemical treatment to remove most of the halogen contamination and render the powder suitable for sintering are given. The sintering characteristics of the powders produced by the above methods are detailed, and compared with those of powder prepared by crushing cast thermally reduced Be. In particular, the microstructures and mechanical properties of the resulting compacts are described, and the contrasting behavior of powders prepared from electrolytic flake as received, and after storage for a year, is shown. This difference in sintering behavior is considered to be due to the presence of particle surface films of variable composition and thickness. (auth)

5878 APEX-292

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

EXPERIMENTAL DETERMINATION OF THE REDUCTION OF INDUCED ACTIVITY IN METALS BY ADDITION OF BORON. J. Moteff, W. J. Stapp, and M. Tetenbaum. Feb. 1957. 6p. Contracts AF33(038)-21102 and AT(11-1)-171. $0.15(OTS).

Curves are presented which indicate additions of 0.5 to 1% additions of B^{10} to stainless steel, tungsten, and thorium results in a significant reduction in neutron activation. (D.E.B.)

5879 CR-MET-683

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE KINETICS OF LAYER FORMATION BY THE INTERDIFFUSION OF Al AND Ni IN EXTRUSION CLAD NICKEL-PLATED URANIUM FLATS. G. V. Kidson. Mar. 1957. 19p. (AECL-421).

The growth of layers of the intermediate phases in the Al–Ni system has been measured metallographically for annealing temperatures of 400, 450, and 500°C and for annealing times up to 144 hours. It has been found that the total layer width W, may be expressed as a function of time t and temperature T by $W^{2.4} = [8.2 \exp(-41{,}500/RT)]\, t$, where W is measured in centimeters, t in seconds, and T in °K. (auth)

5880 LMFP/P-9

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England].

THE EVAPORATION OF POLONIUM FROM BISMUTH MELTS. K. W. Bagnall and D. S. Robertson. [1956]. 2p.

The rate of evaporation of Po from Bi melts is calculated from experimental data. (T.R.H.)

5881 MS-PR-55-68

Kaiser Aluminum and Chemical Corp., Spokane.

THE IMPROVEMENT IN WELD SOUNDNESS BY THE USE OF HALOGENS AND HALIDES IN INERT GAS METAL ARC WELDING OF ALUMINUM. Phase Report No. 1 [for] August 1, 1954 to July 31, 1955 [on] THE WELDING OF HIGH STRENGTH ALUMINUM ALLOYS. A. R. Pfluger and M. B. Kasen. Dec. 30, 1955. 72p. Project No. 817-503. Contract DA-04-200-ORD-333. (AD-107075).

Substantial improvement in weld metal soundness and mechanical properties of weldments can be achieved by the use of halogen and halide additions to the arc area in inert gas metal arc (MIG) welding of high strength aluminum alloys of the Al–Mg–Mn system. The improvement in soundness and mechanical properties of MIG welds made with halogen or halide additions is principally due to the reduction in the amount of large porosity and associated dross normally concentrated at the fusion line (weld metal-base metal interface). This porosity and dross is primarily of the entrained type. Chlorine, particularly at the higher concentrations, i.e., 0.11% and over, also appears to produce a small reduction in the amount of fine pinhole or gas porosity. The use of Cl additions to the arc area permits the use of simplified cleaning procedures, such as degreasing, for cleaning the base plate and filler wire prior to MIG welding, without entailing a sacrifice in weld soundness or strength. The optimum Cl addition, considering both improvement in weld metal soundness and the comfort of the welding operator appears to be about 0.063% Cl_2 by volume at a total A shielding gas flow of 60 cfh. Improved weld metal, as sound as that achieved with Cl additions, can be produced by the addition of $AlCl_3$ vapor to the shielding gas. Small quantities of $MgCl_2$ added to the arc area by use of cored filler wires will result in improved weld soundness and mechanical properties similar to those achieved with Cl additions. The addition of small quantities of $TiCl_4$ to the arc area will result in sounder welds than those made without a $TiCl_4$ addition. The resulting arc characteristics are somewhat better than those obtained when chlorine, $AlCl_3$ or $MgCl_2$ additions are used in the shielding gas. Aluminum alloy filler wires containing several per cent of Mg produce a considerable amount of spatter during MIG welding. This spatter appears to be aggravated by the presence of Cl or chlorides in the arc area, by long arc length and by low welding current. (auth)

5882 NAA-SR-1846

Atomics International Div., North American Aviation, Inc. Canoga Park, Calif.

INTERNAL FRICTION AND SHEAR MODULUS OF THORIUM AT HIGH TEMPERATURES. C. E. Dixon and H. Hori. Apr. 1, 1957. 12p. Contract AT-11-1-GEN-8. $0.15(OTS).

Internal friction and shear modulus measurements were made on iodide-processed Th wire with a torsion pendulum, in vacuum, at temperatures between 20 and 800°C. In small-grained specimens a grain boundary internal friction peak was observed at about 530°C along with a corresponding relaxation of the shear modulus. The activation energy for this relaxation process was found to be 73 ± 7 kilocalories per mole from measurements of the frequency dependence of the position of the peak. (auth)

5883 NACA-TN-3828

Lewis Flight Propulsion Lab., Cleveland.

INVESTIGATION OF THE NiAl PHASE OF NICKEL–ALUMINUM ALLOYS. Edward M. Grala. Oct. 29, 1956. 33p.

The effects of composition and homogenization heat treatments on the room- and elevated-temperature mechanical properties of the cast NiAl intermetallic were determined. Small changes in composition within the NiAl phase field resulted in appreciable strength and hardness changes. Room-temperature hardness of alloys containing 25 to 35% Al exhibited a sharp minimum at 31.5% Al (stoichiometric NiAl). Homogenized NiAl specimens had tensile strengths at room temperature ranging from 29,450 psi for the 25% Al alloy to 14,900 psi for stoichiometric NiAl. At 1500°F the tensile strength of homogenized alloys ranged from 29,050 psi for the 25% Al alloy to 14,500 psi for the stoichiometric alloy. Additions of 0.5 to 2.0% Mo to stoichiometric NiAl reduced the as-cast grain size and significantly increased both room- and elevated temperature strength and ductility. (auth)

5884 NACA-TN-3866

Langley Aeronautical Lab., Langley Field, Va.

FATIGUE TESTS ON NOTCHED AND UNNOTCHED SHEET SPECIMENS OF 2024-T3 AND 7075-T6 ALUMI-

NUM ALLOYS AND OF SAE 4130 STEEL WITH SPECIAL CONSIDERATION OF THE LIFE RANGE FROM 2 TO 10,000 CYCLES. Walter Illg. Sept. 5, 1956. 40p.

Fatigue tests were performed on notched and unnotched fatigue specimens made of 2024-T3 and 7075-T6 aluminum alloys and of SAE 4130 steel. The notched specimens had theoretical stress-concentration factors of 2.0 and 4.0 and the mean loads were 0 and 20 or 50 ksi. It was found that repeated applications of stresses in the vicinity of the ultimate strength on notched and unnotched specimens produced failures in a much smaller number of cycles than might be inferred from previously published data. Ratios of fatigue strengths of unnotched specimens to those of notched specimens are given. (auth)

5885 NACA-TN-3976

Lewis Flight Propulsion Lab., Cleveland.

RUPTURE STRENGTH OF SEVERAL NICKEL-BASE ALLOYS IN SHEET FORM. James H. Dance and Francis J. Clauss. Apr. 1957. 24p.

The 100-hour rupture strengths of Inconel X, Inconel 700, Incoloy 901, Refractaloy 26, and R-235 at 1200° and 1350°F in both the annealed and heat-treated conditions were determined. Inconel 700 had the highest rupture strength at both temperatures; Incoloy 901 was second strongest at 1200°F, and R-235 second strongest at 1350°F. With the exception of Incoloy 901, ductility was low. Photomicrographs show that fractures are through the grain boundaries. Results are compared with published data for other sheet alloys and bar stock. (auth)

5886 NMI-1165

Nuclear Metals, Inc., Cambridge, Mass.

EFFECTS OF RADIATION DAMAGE ON PRECIPITATION-HARDENING ALLOYS WITH SPECIAL REFERENCE TO COPPER–IRON ALLOYS. Alvin Boltax. Oct. 18, 1956. 21p. Contract AT(30-1)-1565. $0.20(OTS).

Studies of the effects of neutron irradiation on precipitation-hardening alloys were carried out on a large number of different alloy systems. Most of this work was concerned with radiation-induced precipitation from supersaturated solid solutions. "Irradiation aging" was observed in Cu–Be alloys at room temperature and in Ni–Be alloys at 300°C. With these experiments as a basis, prerequisites were suggested for "irradiation aging" which involve the atomic number of the principal constituent of the alloy, the activation energy of diffusion, and the critical particle size. It was suggested that the neutron irradiation caused precipitation by accelerating diffusion through the introduction of vacancies and interstitials. Comparatively few experiments have been carried out on the effects of neutron irradiation on aged alloys. Work on Cu–Fe alloys has demonstrated that neutron irradiation can cause re-solution of precipitate particles. The results indicate that the radiation-induced re-solution is dependent upon precipitate particle size. Experimental results obtained on the U–Mo alloys give further evidence for re-solution or homogenization by neutron irradiation. (auth)

5887 NP-6247

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

DEEP DRAWING OF TITANIUM AND TITANIUM ALLOYS. Feb. 20, 1957. 6p.

Deep drawing is a forming process characterized by a slow-moving punch pushing the center of a blank into a die opening with the flange material following immediately thereafter. The center of the blank is stretched somewhat during the process and the area adjacent to the circumference thickens as it is drawn into the cavity. The latter phenomenon tends to cause wrinkling as the material moves past the draw radius; however, this can be avoided by utilizing a pressure pad pressing just hard enough to prevent wrinkling. The final result is a part possessing a wall thickness tapering from a value, at the bottom, thinner than the original blank, to a value, at the top of the side walls, thicker than the original blank, unless "ironing" occurs. (auth)

5888 NRL-4906

Naval Research Lab., Washington, D. C.

ELECTROPLATING BATHS FOR ULTRA-HIGH-STRENGTH STEELS. PART I. USE OF ALIPHATIC AMINO ACIDS IN CADMIUM BATHS TO REDUCE HYDROGEN EMBRITTLEMENT. P. N. Vlannes, S. W. Strauss, and B. F. Brown. Feb. 8, 1957. 15p. Project NR-510-006.

5889 NYO-7789

Aeroprojects, Inc., West Chester, Penna.

APPLICATIONS OF ULTRASONIC ENERGY. Progress Report No. 1 Covering Period from October 16, 1956 to December 15, 1956. Feb. 12, 1957. 22p. Contract AT(30-1)-1836. $3.30(ph OTS); $2.40(mf OTS).

Investigations were initiated in applying elastic vibratory energy to three problems of the Atomic Energy Commission: fuel element dissolution, compound crystallization, and powder metallurgy. The dissolution of disks of Mo, Zircaloy-2, and Type 304 stainless steel sheet in hot acid solutions was markedly accelerated by close-proximity ultrasonic treatment. Preparatory to studies of the ultrasonic effect on Th bismuthide crystal size and shape,, acoustic intensity in molten Bi was found to be high in the cavitation zone adjacent to the ultrasonic coupler face, but to drop off rapidly with distance. Significant factors in ultrasonic application to several powder metallurgy problems were examined, and designs for suitable experimental equipment were projected. (auth)

5890 WADC-TN-55-290(Pt. 2)

Babcock and Wilcox Co. Research Center, Alliance, Ohio.

DEVELOPMENT OF CAST IRON-BASE ALLOYS OF AUSTENITIC TYPE FOR HIGH HEAT-RESISTANCE AND SCALE-RESISTANCE. Period Covered: June 1955 to July 1956. F. Eberle, J. H. Hoke, and W. E. Leyda. Sept. 15, 1956. 98p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF33(616)-2413. (AD-110716).

Iron-base alloys containing a minimum Fe content of 45%, a minimum C content of 0.50%, a Cr content of not less than 20%, and between 27 and 32% Ni, part of which may be replaced by Co, can develop a creep-rupture strength at 1600 to 1800°F approaching that of the Co-base alloy H.S. 21 when they are strengthened by not more than 5% additions of Nb, Ta, Mo, and W in certain combinations and relative concentrations. These high-creep-rupture-strength Fe-base alloys are equal to H.S. 21 in oxidation resistance at 2000°F, but inferior to the former in short-time cold and hot tensile strength, in cold ductility, and in resistance to thermal shock and thermal fatigue. The possibility of improving the latter by lowering the C content and compensating the resulting decrease in rupture strength with suitable modifications in composition has not been explored. (auth)

5891 WADC-TR-55-495(Pt.II)

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

MEASUREMENTS OF THERMAL PROPERTIES. Report [for the Period] August 17, 1955 to August 16, 1956. I. B. Fieldhouse, J. C. Hedge, J. I. Lang, and T. E. Waterman. Sept. 21, 1956. 23p. Project title: HIGH TEMPERATURE MATERIAL PROPERTIES. Task title: [ATLAS MATE-

RIALS]. Contract AF33(616)-2903. (AD-110510).

The results of specific heat measurements over the temperature range of 2000 to 3000°F are presented. A discussion of the apparatus and operational methods and an estimate of the accuracy of the results are given. A comparative method was used to determine the thermal conductivity of the liquid sample. Heat was passed downward from an electric heater, through the sample, through a disk of Mo, whose thermal conductivity as a function of temperature is known, to a heat sink. This was necessitated due to the convection currents which are set up if the sample is heated from below. (auth)

5892 WADC-TR-56-372

Wright Air Development Center. Aeronautical Research Lab., Wright-Patterson AFB, Ohio.

CERAMIC CRUCIBLE FOR MELTING TITANIUM. Berthold C. Weber, William M. Thompson, Hans O. Bielstein, and Murray A. Schwartz. June 1956. 62p. Project title: CERAMIC AND CERMET MATERIALS. Task title: HIGH TEMPERATURE AND HIGH STRESS CHARACTERISTICS OF CERAMICS AND CERMETS. (AD-97285).

Research studies have resulted in the development of an oxygen-deficient zirconia material modified in a novel way to make it thermally stable and inert against the attack of molten Ti. It was possible to melt Ti in this crucible with no significant increase in hardness. However, limitations regarding overheating and soaking must be taken into account. (auth)

5893 WADC-TR-56-409

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

AUTORADIOGRAPHIC STUDY FOR THE DISTRIBUTION OF THORIUM IN MAGNESIUM ALLOYS. [Period] covered: April 1, 1955–March 16, 1956. Kurt Wolfsberg and George John. Aug. 20, 1956. 43p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: APPLICATIONS OF RADIOISOTOPES. (AD-110571).

An autoradiographic study of Mg alloys containing 3% and 13% Th has been performed. The stripping film method was slightly modified because of the extreme reactivity of Mg. The results show qualitatively that a large percentage of the thorium is located in or very near to the grain boundaries. (auth)

5894 WADC-TR-56-411

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

THE CONSTITUTIONAL AND AGING CHARACTERISTICS OF MAGNESIUM–THORIUM AND MAGNESIUM–THORIUM TERNARY ALLOYS. Albert S. Yamamoto, Edmund J. Klimek, and William Rostoker. Nov. 27, 1956. 75p. Project Title: METALLIC MATERIALS. Task title: EFFECT OF COMPOSITION AND STRUCTURE ON THE PROPERTIES OF ALLOYS. Contract AF33(616)-2571. (AD-118107).

A partial diagram from 0 to 70 wt.% Th of the binary Mg–Th system was constructed. The features of the diagram include a eutectic reaction at 582°C and at 42% Th with the participating phases of the Mg solid solution (about 4.5% Th) and compound Mg_5Th (65% Th). The Mg_5Th phase identified by lineal analysis forms on cooling by a peritectic reaction between the melt of about 53% Th and a Th-rich phase. The solid solubility of Th in Mg decreases with decreasing temperature from about 4.5% Th at the eutectic temperature to less than 1% Th at 300°C. In the Mg–Th–Zn ternary system a tentative vertical section diagram at constant 1% Zr was constructed up to 65 wt.% Th. The addition of Zr up to 1% does not change appreciably the liquidus boundaries from that of the binary system. Neither the formation of ternary intermediate phases during solidification is found nor the occurrence of solid state reactions as low as 300°C. The solid solubilities of Th in Mg are slightly reduced by the presence of Zr. For the Mg-rich region of the Mg–Th–Zn system, two isothermal section diagrams (at 400 and 300°C, respectively), liquidus, solidus and solvus surfaces were determined. The θ phase which is foreign to both the Mg–Th and the Mg–Zn systems was found to exist in this ternary system. This phase enters into equilibrium with Mg in a wide composition range at two temperatures. It is still undertermined if the θ phase is a true ternary compound. Aging characteristics of seven selected alloys were investigated at 350, 250 and 150°C in terms of room temperature tensile properties; one binary Mg–Th alloy and three ternary alloys each from the Mg–Th–Zr and Mg–Th–Zn systems. The aging results indicate that these alloys respond only moderately and almost in the same magnitude to age-hardening. However, the outstanding feature of these alloys is that they overage at 350°C but maintain a high level of overaged strength for a long period of time. (auth)

5895 WADC-TR-56-545

Battelle Memorial Inst., Columbus, Ohio.

DEVELOPMENT OF A HEAT-TREATABLE TITANIUM ALLOY HAVING ADEQUATE FORMABILITY. Period Covered: May 1955 to July 1956. Herbert A. Robinson, Andrew J. Griest, Alvin M. Sabroff, and Paul D. Frost. Nov. 15, 1956. 77p. Project title: METALLIC MATERIALS. Task title: TITANIUM METAL AND ALLOYS. Contract AF33(616)-2901. (AD-110737).

A series of 27 experimental alpha-beta Ti alloys were melted, forged, rolled to sheet, and evaluated as potential formable and heat-treatable sheet alloys. Formability was evaluated by true stress-true strain tensile data and by bend tests. In general, the solution temperature had greater effect than alloy composition on the relative formability of the alloys in the as-quenched condition. However, several compositions appeared to offer greater promise than the others from the standpoints of formability and ability to be aged, after forming, to a high strength level. A Ti–3Fe–3Mo–2Al alloy was of particular interest. Additional research on this and other alloys is recommended. (auth)

5896 WADC-TR-56-579

Horizons, Inc., Cleveland.

DEVELOPMENT OF FRICTION-SEAL MATERIALS FOR HIGH TEMPERATURE-HIGH SPEED OPERATION. Period Covered: July 1, 1955 to July 31, 1956. Peter F. Mataich. Oct. 25, 1956. 23p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF33(616)-3134. (AD-118047).

A study was made in an attempt to find materials suitable for use as friction seals under conditions of high temperature and high rubbing speeds. A special test rig for screening the materials under simulated operating conditions was designed and constructed. It was found that the group of materials evaluated in the present program showed excessive wear under the severe operating conditions required. This excessive wear was attributed to the excessive temperatures reached at the mating surfaces when the lubricating oil film broke down, and it is suggested that this condition could be remedied by incorporating a suitable solid lubricant in the seal material itself. (auth)

5897 WADC-TR-57-30

Case Inst. of Tech., Cleveland.

THE INFLUENCE OF HYDROGEN ON DELAYED FAILURE IN TITANIUM ALLOYS. Period [covered] January 3,

1955 to January 3, 1957. R. D. Daniels, E. L. Harmon, Jr., and A. R. Troiano. Feb. 1957. 47p. Project title: METALLIC MATERIALS. Task title: DEFORMATION MECHANISMS OF METALS. Contract AF33(616)-2771. (AD-118136).

Notch geometry, strength level, H_2 concentration and H_2 distribution exerted an appreciable influence on delayed failure characteristics of a 4 Al–4 Mn–Ti alloy. Hydrogen-induced delayed failure in sharply notched material occurred by a process of crack initiation and slow crack propagation. The average rate of crack growth was accelerated as the H_2 content increased, and appeared to be independent of applied stress. The crack initiation and propagation process under certain conditions of stress was complicated by room temperature creep. A high concentration of H_2 at the surface of a specimen was conducive to early crack formation, and crack growth rates appeared dependent upon inward diffusion of H_2 from the surface. (auth)

5898

OXIDATION OF ZIRCONIUM BETWEEN 400° AND 800°C. Earl A. Gulbersen and Kenneth F. Andrew (Westinghouse Electric Corp., Pittsburgh). J. of Metals 9, 394-400(1957) Apr.

The vacuum microbalance method is used to study the oxidation reaction for two surface preparations over the temperature range of 400 to 800°C. The results fit in well with the authors previous work at temperatures of 200 to 425°C and with the work of other groups at higher temperatures. An analysis of the rate data shows that the cubic rate law fits the experimental data best for the abraded specimens. However, the parabolic rate law can be fitted to the data if an initial deviation is disregarded. With chemically polished specimens, a good fit is obtained with the parabolic rate law. The parabolic rate law constant A gives two straight lines when plotted as log A vs 1/T. For the temperature range of 200 to 525°C an energy of activation of 18,200 cal per mol is calculated while a value of 28,600 cal per mol is calculated for the temperature range of 525 to 750°C. The results of this work bring together the previously determined high-temperature oxidation studies of Cubicciotti with the early low-temperature studies of Gulbransen and Andrew. (auth)

5899

EFFECTS OF SOLID SOLUTION ALLOYING ON CREEP DEFORMATION OF ALUMINUM. Gordon D. Gemmell (E. I. DuPont Co., Wilmington, Del.) and Nicholas J. Grant (Massachusetts Inst. of Tech., Cambridge, Mass.). J. of Metals 9, 417-23(1957) Apr.

The effects of solid solution alloying on the creep-rupture properties, deformation characteristics, ductility, and fracture of pure aluminum were studied by means of creep-rupture tests on polished specimens of three alloys each of Al–Cu (0.24, 0.79, and 2.05 % Cu), Al–Zn (4.93, 9.89, and 19.78 % Zn), and Al–Mg (0.94, 1.92, and 5.10 % Mg at 500°, 700°, and 900°F. (auth)

5900

HIGH-STRENGTH ZIRCONIUM ALLOY: Zr–4 Wt. Pct Sn–1.6 Wt. Pct Mo. W. Chubb (Battelle Memorial Inst., Columbus, Ohio). J. of Metals 9, 461-8(1957) Apr.

A heat-treatable, ternary alloy of zirconium is described. This alloy is readily rolled at 800°C and has more than four times the creep strength of pure zirconium at 500°C. The tensile strength of the alloy in the annealed condition is about 90,000 psi, and it may be heat-treated to a strength of more than 140,000 psi. In the annealed condition, the alloy can be cold reduced more than 20%. The alloy is harder in the air-quenched condition than as water quenched. This behavior was found to be associated with a reaction similar to age hardening. (auth)

5901

COMPOUNDS IN THE TITANIUM-RICH REGION OF THE Ti–Al SYSTEM. Elmars Ence and Harold Margolin (New York Univ.). J. of Metals 9, 484-5(1957) Apr.

5902

APPLICATIONS OF NONDESTRUCTIVE TESTING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. W. J. McConnagle and Stuart McLain (Argonne National Lab., Lemont, Ill.) and E. C. Wood (General Electric Co., Hanford, Wash.). Non-Destructive Testing 15, 86-90 (1957) Mar.-Apr.

The applications of various nondestructive tests to check bond integrity, weld integrity, tubing, clad thickness, and grain size and orientation in fuel elements of nuclear reactors are discussed. The isothermal frost test is described in detail. (auth)

5903

ANOMALOUS ISOTOPE EFFECT IN METALLIC DIFFUSION. David Lazarus and Boudewijn Okkerse (Univ. of Illinois, Urbana). Phys. Rev. 105, 1677-8(1957) March 1.

It is predicted that if two different isotopes of the same element diffuse into a solid, the lighter isotope will diffuse faster than the heavier by the ratio of the square root of the isotopic masses. In order to check the theory, the diffusion of Fe^{55} and Fe^{59} in pure monocrystalline Ag was studied. Experimental results are shown graphically. It is found that the lighter isotope diffuses more rapidly than the heavier but that the relative difference in diffusion coefficients is about 4 times larger than predicted by theory. (B.J.H.)

5904

STAINLESS STEEL FOR WELDED PRESSURE VESSELS. A. Grodner (Continental Copper and Steel Industries, Inc.). Welding J. (N. Y.) 36, 169s-76s(1957) Apr.

The properties and fabrication characteristics of wrought and cast stainless steel used for pressure vessel construction to meet requirements for processing industries are described. (auth)

5905

DESIGN AND TECHNIQUE REQUIREMENTS FOR ARC WELDING TITANIUM IN AIRCRAFT APPLICATIONS. R. Meredith and B. L. Baird (North American Aviation, Downey, Calif.). Welding J. (N. Y.) 36, 371-7(1957) Apr.

Zigging methods, welding techniques, and design consideration required for making Ti welds which meet aircraft standards are discussed. (auth)

5906

MATERIALS SURVEY; ALUMINUM. Washington, Department of Commerce, 1956. 324p. Available from GPO for $2.50.

5907

OXIDATION OF 50 WEIGHT PER CENT URANIUM-ZIRCONIUM ALLOY. Sidney Barnartt, Robert G. Charles, and Earl A. Gulbransen (Westinghouse Electric Corp., Pittsburgh). J. Electrochem. Soc. 104, 218-21(1957) April.

The reaction of 50% U–Zr with O_2 at 1 atm. pressure was studied over the range 200 to 500°C. Two forms of the alloy, the stable ϵ-phase and the quenched γ phase, were reacted to an oxide-scale thickness of 0.1 mm at the higher temperatures. In general, the weight gain increased linearly with time, although in many cases the oxidation curve showed a bend and could be represented by two straight lines. At 400°C and above, the stable ϵ-phase reacted considerably faster than the γ phase. The thick oxide scales were porous and showed uranium enrichment. During the

formation of thin oxide films at 200 and 250°C the reaction followed the parabolic rate law approximately. The alloy oxidizes somewhat more rapidly than pure Zr, but very much more slowly than U. (auth)

5908

ELECTROLYTIC HYDROGEN EVOLUTION KINETICS AND ITS RELATION TO THE ELECTRONIC AND ADSORPTIVE PROPERTIES OF THE METAL. B. E. Conway and J. O'M. Bockris (Univ. of Pennsylvania, Philadelphia). J. Chem. Phys. 26, 532-41(1957) March.

A significant correlation between the logarithm of the exchange current density i_0 of the electrolytic hydrogen evolution reaction and the electronic work function ϕ is found for one group of metals. Another group of metals probably having a different relationship is distinguished. The relationship between $\log i_0$ and ϕ is explained as arising from the dependence of heat of adsorption upon ϕ. A general theory of electrolytic reduction and electrode poisoning is given. A mathematical analysis of the dependence of the rate of the proton discharge reaction in terms of the heat of adsorption of H, MH bond force constants, and internuclear distance, is given. (auth)

5909

LOW-PRESSURE SOLUBILITY AND DIFFUSION OF HYDROGEN IN ZIRCONIUM. M. W. Mallett and W. M. Albrecht (Battelle Memorial Inst., Columbus, Ohio). J. Electrochem. Soc. 104, 142-6(1957) March.

Low-pressure solubilities were determined for H in α- and β-Zr and in two Zr–O alloys at 700 to 1000°C and pressures of 0.1 to 4 μ Hg. The data followed Sieverts' law for each phase, and H solubility decreased with increasing temperature at a given pressure. Also, there was a slight increase in H solubility in α-Zr with increasing oxygen content. Diffusion coefficients for H in α Zr were obtained in the range 300° to 600°C by analysis of prepared concentration gradients. In the range 600 to 800°C, degassing coefficients were determined from rate of H evolution from Zr cylinders. Degassing coefficients were much lower than expected from diffusion theory, and it was concluded that the degassing was not a pure diffusion phenomenon. Terminal solubilities obtained from the gradient analysis were in good agreement with those found by previous investigators. (auth)

PHYSICS

5910 AECU-3384

Internuclear Co., Clayton, Mo.

COST ESTIMATE FOR THE FOOD IRRADIATION REACTOR. (INTERNUC-6). Aug. 23, 1956. 14p. Contract AT(30-3)-252. $0.60(OTS).

5911 AERE-C/R-985

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE MAGNETIC SUSCEPTIBILITY OF PLUTONIUM IN THE REGION 20-350°C. J. K. Dawson. July 17, 1952. 11p.

The magnetic susceptibility of Pu has been measured in the α, β, γ, and δ phases, and the transition temperatures have been determined on the purest available material. The results are also discussed in terms of the possible electron states of the metal. (auth)

5912 NURG/M-17

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

WALL FRICTION IN ANNULI. O. Pulley. Feb. 1952. Decl. Nov. 22, 1956. 26p.

The shear forces due to fluid friction on the surfaces of simple and of longitudinally finned annuli are investigated analytically and by relaxation methods. Tables and curves are given of the mean shear stresses and total shear forces for a range of fin lengths and spacings. The analogy between wall friction and heat transfer is quoted and inferences made of the efficiency of various fin arrangements in removing heat from the inner surface of an annulus. Finally a graph is presented from which the number of fins and the efficiency can be estimated for a given surface increase factor. The latter is fixed by optimum output conditions. (auth)

5913

DENSITY OF LIQUID He^4. Eugene C. Kerr (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 26, 511-14(1957) March.

The density of He^4 under its own vapor pressure has been measured between 1.2°K and 4.4°K by a direct method. The results are given in smoothed tabular form and are compared with the results of previous measurements. An attempt has been made to derive a usable value for the critical density from the liquid and vapor densities at lower temperatures. (auth)

5914

DENSITY AND ELECTRICAL CONDUCTANCE IN THE SYSTEM KCl-$ZnCl_2$. Frederick R. Duke and Richard A. Fleming (Iowa State Coll., Ames). J. Electrochem. Soc. 104, 251-4(1957) April.

The phase diagram of the system KCl–$ZnCl_2$ indicates the presence of the solid-state $2KCl \cdot ZnCl_2$. Density vs. composition isotherms in the range 475 to 650°C are approximately linear. Isotherms of equivalent conductivity deviate negatively from additivity when plotted against composition, the maximum negative deviation being found near $X_{KCl} = 0.71$. The heat of activation for ionic migration falls rapidly from that of $ZnCl_2$ until X_{KCl} has reached 0.30, then slowly falls to the limiting value for pure KCl. (auth)

5915

ATOMIC POWER FOR PEACE. VOLUME 5. GLOSSARY OF COMMON ATOMIC TERMS. W. J. Vogt. Johannesburg, Union of South Africa, Atomic Power Review, 1956. 36p.

5916

GROUND STATE OF THE HELIUM ATOM. Toichiro Kinoshita (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 105, 1490-1502(1957) March 1.

The energy level of the ground state of atomic helium is restudied in detail. The nonrelativistic part is treated by the conventional Ritz variation technique. However, the trial functions used are more general than the ordinary Hylleraas-type functions since they contain negative power terms in addition to the positive power terms. Linear combinations of up to 39 terms are employed in the numerical computation. The best approximation for the ground state energy of the nonrelativistic Schrödinger equation obtained so far is −2.9037225 atomic units. The precision of the variation result is estimated by the evaluation of lower bounds to the ground state energy. The final result is about twelve times more accurate than the best published value. On the basis of these calculations, it is conjectured that the actual nonrelativistic energy will be lower than our best value by not more than 0.0000012 atomic unit. The accuracy of various approximate eigenfunctions is also estimated. It is thus found that the total contribution to the 39-parameter function from all the excited states will be of the order of 0.1%. Mass polarization and relativistic corrections are evaluated with various trial functions including our best ones. They seem to converge to certain limits with reasonable speed. It is believed that the mass polarization and relativistic corrections to the ionization potential of the He ground state

will be very close to -4.78_6 cm^{-1} and -0.57_0 cm^{-1}, respectively. With these corrections, and also the Lamb-shift correction for the ground state of the He atom (-1.23 cm^{-1}), the theoretical ionization potential becomes 198310.38 cm^{-1} which is in a very good agreement with the best observed value 198310.5 ± 1 cm^{-1}. (auth)

AEROSOLS

5917

AIR POLLUTION. Kingsley Kay (Dept. of National Health and Welfare, Ottawa, Can.). Anal. Chem. 29, 589-604(1957) April.

A review, including 498 references, is presented which is concerned with the study of aerosols and gas and vapor analysis. Aerosol collection techniques are reviewed along with methods of aerosol analysis, physical measurements on suspended particles, and aerosol generators. The topics treated under gas and vapor analysis are: collection of gases and vapors, analysis for nitrogen oxides, ozone and related oxidants, hydrocarbons and related problems, other developments for SO_2 and H_2S, HF, CO, other instrumentation and application. (T.R.H.)

COSMIC RADIATION

5918

VARIATIONS OF COSMIC-RAY INTENSITY THE 21, 22, AND 23 OF JAN. 1957. Jean-Pierre Legrand, Paul Chanson, and Michel Bonpas. Compt. rend. 244, 1362-4 (1957) Mar. 4. (In French)

5919

A CASCADE SHOWER IN NUCLEAR EMULSIONS. Senzo Tokunaga and Taka Ishii (Saikyo Univ., Kyoto) and Kiyoshi Nishikawa (Wakayama Univ.). J. Phys. Soc. Japan 12, 219-21(1957) Mar.

A good example of a cascade shower in nuclear emulsions was analyzed, and its energy was determined from its lateral distribution at successive stages of its development comparing with cascade theory, and was found to be 2.5×10^{11} ev. It is possible to measure the energy of high-energy γ rays or electrons with an accuracy of a factor two. (auth)

5920

ON THE CORRELATION OF THE INTENSITY OF μ^-- AND μ^+-MESONS WITH THE PRESSURE AT SEA-LEVEL, AND WITH THE HEIGHT OF THE 100 mb LAYER. U. Fasoli, C. Maroni, I. Modena, E. Pohl, and J. Pohl-Ruling. Nuovo cimento (10) 5, 473-82(1957) Feb.

The vertical intensities of μ^+ and μ^- mesons have been measured by means of a counter apparatus with magnetic discrimination for the sign of charge. The mean daily counting rates are 5 500 μ^+ and 4 600 μ^- extended over 18 months. The coefficients for correlation between the intensities of the μ^+ and μ^- with the atmospheric pressure at sea-level (α^+ and α^-) and with the height of the 100 mb layer (γ^+ and γ^-) have been obtained. There is a difference between the coefficients for the two types of mesons which is beyond the statistical errors; in fact $|\alpha^-|>|\alpha^+|$ and $|\gamma^+|>|\gamma^-|$. The results have been interpreted by means of a particular integral of the diffusion equation, considering the mesons as being produced by two distinct sources: one due to the collisions between the primary component with the nuclei of the upper atmosphere and the other due to the secondary nucleonic component. (auth)

5921

MULTIPLE MESON PRODUCTION AND ANGULAR DISTRIBUTION OF SHOWER PARTICLES PRODUCED IN COSMIC RAY "JETS". L. V. Lindern. Nuovo cimento (10) 5, 491-501(1957) Feb.

In nuclear emulsions exposed to the cosmic radiation, showers have been studied which are produced by singly charged or neutral particles, mainly nucleons (i.e. "jets" or mesonic showers; their total, number being 22.) The analysis has been restricted to events whose primary energies are greater than 20 Bev, and the number of visible shower particles of which are equal to or greater than 8. An upper limit of $N_h = 3$ for the "heavy" and "grey" prongs has been chosen for each event. (The total number of charged shower particles is 255 and of "grey" or "heavy" prongs is 28.) Such selected showers are interpreted in terms of multiple meson production, and the shower particles are supposed to be mainly mesons produced at one single nucleon-nucleon collision. Within the spread of primary energies observed (20 to 500 Bev) the angular distribution of shower particles shows a significant deviation from isotropic emission in the center of mass system of the two colliding nucleons. (auth)

5922

INVESTIGATION OF AN ELECTROMAGNETIC CASCADE OF VERY HIGH ENERGY IN THE FIRST STAGE OF ITS DEVELOPMENT. M. Miesowicz, O. Stanisz, and W. Wolter (Inst. of Nuclear Physics, Krakow). Nuovo cimento (10) 5, 513-16(1957) Feb.

An analysis is given of a cascade generated probably by a single photon of an energy near 10^{12} ev. In particular, an attempt was made to determine whether there was a deficiency of low-energy pairs as compared with the number of high-energy pairs. (B.J.H.)

5923

NUCLEAR DISINTEGRATION CASCADES BY HEAVY PRIMARIES. S. Tokunaga and T. Ishii (Saikyo Univ., Kyoto, Japan) and K. Nishikawa (Wakayama Univ., Japan). Nuovo cimento (10) 5, 517-19(1957) Feb.

Two events of nuclear disintegration cascades by heavy primaries were found in a stack of 48 Ilford G5 emulsions which was flown at a maximum altitude of 8 mb. Complete descriptions and photographs of the events are included. (B.J.H.)

5924

INTERACTIONS OF THE HEAVY NUCLEI OF THE COSMIC RADIATION. P. H. Fowler, R. R. Hillier, and C. J. Waddington (H. H. Willis Physical Lab., Bristol). Phil. Mag. (8) 2, 293-304(1957) Mar.

Observations were made in a systematic manner of 317 nuclear interactions produced by the heavy nuclei of the primary cosmic radiation in nuclear emulsions. From a study of these interactions the interaction mean free paths and fragmentation probabilities were found. The interaction mean free paths are in good agreement with those reported previously. The fragmentation probabilities, particularly those for the production of light nuclei, are considerably smaller than those currently accepted. In addition, from a study of the angular distribution of the nuclei emitted from the interactions it is shown that the energies of emission in the C-system of the incident nucleus are greater than those previously accepted and depend on the charge of the primary nucleus. (auth)

5925

COSMIC-RAY BURSTS UNDER LEAD AT SEA LEVEL. Hugh Carmichael and John F. Steljes (Atomic Energy of Canada, Ltd., Chalk River, Ontario). Phys. Rev. 105, 1626-35(1957) March 1.

The integral size-frequency distributions of ionization bursts near sea level were measured in a thin-walled ($^1/_{16}$ inch steel), 8-inch diameter, spherical ion-chamber filled

with argon at 50 atmos pressure, under 14 different thicknesses of lead ranging from 0.11 cm to 22 cm. The measurements, along with those already published for the ion chamber with no shield and with a 27-cm lead shield, represent some 15 000 hours of recording. The range of size covered extends from about 3×10^4 to 10^8 ion pairs. In a subsidiary experiment the size-frequency distributions of bursts directly associated with extensive air showers were measured and to these were added, at each thickness of the shield, the bursts due to single μ mesons, protons, and stars derived from the analysis already published. These totals were then subtracted from the gross size-frequency distributions. The bursts remaining are almost wholly due to the electrons and photons of the soft component and to the radiative and knock-on processes of μ mesons. Transition curves of these bursts (Rossi curves) are given for selected sizes, corresponding (on the average) to showers of 1, 2, 4, 8, ..., 512 electrons crossing the ion chamber. There is no sign of a second maximum in these transition curves. There is strong evidence that the cascades which give rise to the "first" maximum originate from single electrons or photons incident on the lead shield and hence these experimental results are suitable for a straightforward comparison with cascade theory in an energy range extending to some 50 Bev. Indications of a transition effect of the bursts attributed to stars are noted. (auth)

5926

IMPACT ZONES FOR SOLAR COSMIC-RAY PARTICLES. R. Lust (Univ. of Chicago, Ill.). Phys. Rev. 105, 1827-39 (1957) Mar. 15.

Orbits for cosmic-ray particles starting from the vicinity of the sun and passing through the geomagnetic dipole field were integrated by using the AVIDAC computer at the Argonne National Laboratory. The methods for integration used in Chicago and Göttingen were compared. Counting rates at the top of the atmosphere were calculated from the integrated orbits in order to make possible the analysis of cosmic-ray intensity increases during solar flares. Different source widths and declinations were assumed. The calculated counting rates are based on a flat rigidity spectrum at the source. This investigation shows that: (a) distinctive impact zones exist even for large source widths; (b) the position of these zones and the counting rates within these zones depend strongly upon the declination of the source; (c) the earth's magnetic field produces a focusing effect especially at higher latitudes. (auth)

5927

MASS MEASUREMENTS OF SLOW COSMIC-RAY MESONS. M. Inoki, T. Yasaki, M. Machida, and Y. Matsukawa (Yamanashi Univ., Kofu, Japan). Phys. Rev. 105, 1872-4 (1957) Mar. 15.

The masses of slow charged cosmic-ray particles (except those of protonic mass) in the soft and hard components were separately determined by measuring momentum, momentum loss, and ionization with a magnetic cloud chamber at sea level. With respect to meson masses, however, no appreciable difference between the two components could be found. Eighty out of 87 observed particles were interpreted as μ mesons, leaving 7 anomalous ones. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

5928 AEC-tr-2869

LATENT PERIODS OF CRYSTALLIZATION AND AN EQUATION FOR THE VELOCITY OF FORMATION OF CRYSTAL NUCLEI. M. L. Chepelevetskii (Chepelevetskiy). Translated from Zhur. Fiz. Khim. 13, 561-71(1939). 24p.

A determination was made of the latent period of crystallization of a number of salts from supersaturated aqueous solutions, in particular those containing calcium phosphates, from aqueous solutions of phosphoric acid. A study was made of the correlation between the magnitude of latent period, the supersaturation, and the temperature. The magnitude of the latent period of crystallization reflects the rate of formation of nuclei and their growth. The equation of the rate of formation of crystallization nuclei was found to be analogous to the equation of condensation of a liquid from vapor, the difference being that in the formation of crystal nuclei in solutions the viscosity of the medium must be taken into account. It is shown that on introduction of the viscosity into the equation of kinetics the latter can serve for an approximate calculation of the average surface energy of the crystals at the solid-liquid boundary. (auth)

5929

THE STRUCTURE OF V_4Al_{23}. J. F. Smith and A. E. Ray (Iowa State Coll., Ames). Acta Cryst. 10, 169-72(1957) March.

The crystal structure of the intermetallic compound V_4Al_{23} has been determined. The space-group symmetry was found to be D^4_{6h}–$P6_3/mmc$, and precision lattice parameters were measured as $a = 7.692_8$ A, $c = 17.04_0$ A. The compound is structurally related to Co_2Al_5, Fe_3NiAl_{10}, and Mn_3SiAl_9. The compound shows a pronounced, but imperfect, layering. Zone boundaries are prominent. Abnormally short Al–V bond distances were found. (auth)

5930

HIGH-SPEED COMPUTATION OF THE ABSORPTION CORRECTION FOR SINGLE CRYSTAL DIFFRACTION MEASUREMENTS. William Busing and Henri A. Levy (Oak Ridge National Lab., Tenn.). Acta Cryst. 10, 180-2(1957) March.

A program is described for the high-speed computation of the absorption correction factor for single-crystal diffraction measurements. The method requires that the sample boundaries be approximated by plane surfaces and that there be no re-entrant angles between these planes. (auth)

5931

ETCHING BEHAVIOR OF PILE-IRRADIATED GERMANIUM AND SILICON SINGLE CRYSTALS. Roger Chang (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 28, 385-7(1957) Apr.

Germanium single crystals pile-irradiated at 20°C and 10^{14} to 10^{17} n/cm^2 etch differently from similar crystals which have not been irradiated. The irradiated crystals when etched with CP-4 show a finer surface granulation. This difference in etching behavior is reduced on annealing. Kinematic studies indicate an activation energy for the annealing process between 1.6 and 1.8 ev. The etching behavior of silicon single crystals shows a similar change on pile irradiation. The present work, though preliminary in nature, suggests a new experimental approach to the study of radiation damage. (auth)

5932

NEUTRON DIFFRACTION STUDY OF CALCIUM HYDROXIDE. William R. Busing and Henri A. Levy (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 26, 563-8(1957) March.

Single crystal neutron diffraction measurements on $Ca(OH)_2$ at 20°C and −140°C confirm the x-ray structure and the hydrogen positions previously postulated. Refinement of the neutron data by Fourier and least squares procedures yields a detailed description of the thermal motions. The amplitudes of the motion of the hydrogen atoms are compared with those deduced from infrared and Raman studies. The O–H distance, after allowance for asymmetric thermal motion, is 0.984 A. (auth)

ELECTRICAL DISCHARGE

5933 AEC-tr-2841
PARTITION FUNCTION AND EFFECTIVE IONIZATION POTENTIAL OF AN ATOM IN THE INTERIOR OF A PLASMA. G. Ecker and W. Weizel. Translated from Ann. Physik 17, 126-40(1956). 19p.

A knowledge of the atomic partition function and the effective atomic work function is of decisive importance for the calculation of the properties of a plasma. As regards the partition function there is a well-known divergence difficulty, whose elimination is of interest both numerically and as a matter of principle. Existing attempts to limit the number of terms either start from impermissible assumptions or content themselves with a crude cutting-off of the series of terms. Measurements of the effective ionization potential by various procedures have given results that are in marked contradiction with each other. Theoretical determinations of the lowering of the ionization potential have resulted in rough estimates. An investigation intended to clarify this situation is presented. As concerns the partition function, a calculation of the atomic term system with account taken of the interaction of the atom with the carriers in the plasma shows that in the interior of the plasma the series of terms is finite and indeed decidedly limited. These results make possible a reliable determination of the numerical value of the partition function. A critical discussion is given of the concept of effective ionization potential. A calculation of the lowering of the atomic work function leads to a simple and easily interpreted dependence on the electron density and the temperature. The calculated values lie between the results obtained by means of the various methods of measurement. Comparison between experiment and theory is not possible because of the experimental uncertainty. (auth)

5934 AEC-tr-2851
MEASUREMENTS OF HIGH FREQUENCY ELECTRODELESS DISCHARGE PARAMETERS WITH TWO PROBES. L. Biberman and B. Panin. Translated from Zhur. Tekh. Fiz. 21, 12-17(1951). 9p.

A method of measuring the parameters of a high-frequency electrodeless discharge using 2 identical parameters to obtain the current-voltage characteristic is offered. The electron temperature and concentration are determined from the characteristic. (auth)

5935 AEC-tr-2857
THE MEASUREMENT OF ELECTRON AND POSITIVE ION ENERGIES IN A GAS DISCHARGE PLASMA. N. I. Ionov. Translated from Doklady Akad. Nauk S.S.S.R. 85, 753-5 (1952). 5p.

Descriptions are given of a probe which was used to measure electron and positive ion energies in a gas discharge plasma. The probe consisted of a 3-plate flat condenser with 20-mm plate diameter made of Pt ribbon. The system was in a glass tube which was welded to the discharge tube halfway between the cathode and anode. Measurements made with this probe are discussed. (B.J.H.)

ELECTRONS

5936
ON THE ANNIHILATION OF POSITRONS IN METALS. V. I. Karpman and I. Z. Fisher (Minsk Pedagogical Inst.) Doklady Akad. Nauk S.S.S.R. 111, 1212-14(1956) Dec. 21. (In Russian)

Studies were made of positron life in various metals and it was shown that an accurate calculation of positron life time directly annihilated by free electrons agrees with the experimental data obtained by R. Bell and R. Graham (Phys. Rev. 90, 644(1953)). Any formation of positronium in metals proved to be quite improbable. (R.V.J.)

5937
THE PRODUCTION OF RECOIL ELECTRONS BY THE PASSAGE OF ENERGY-RICH μ MESONS THROUGH IRON AND LEAD. U. Pfeiffer. Z. Naturforsch. 12a, 148-53 (1957) Feb. (In German)

GASES

5938
DIFFUSION AND GAS SORPTION RATES OBEYING THE ELOVICH EQUATION. Thomas Freund (New York Univ., N. Y.). J. Chem. Phys. 26, 713(1957) March.

5939
STRUCTURE OF A SHOCK FRONT IN ARGON. John W. Bond, Jr. (General Electric Co., Philadelphia, Penna.). Phys. Rev. 105, 1683-94(1957) Mar. 15.

Steady one-dimensional shocks of such strength that one degree of ionization is of importance are considered. The equation of state of argon is computed, equilibrium conditions behind the shock front are evaluated, and a recombination coefficient derived from detailed balancing. It is shown that for a given shock velocity the shock front is flat and nonluminous at first but soon becomes luminous with corresponding change in hydrodynamic variables and degree of ionization, and that the flat portion decreases in width with increasing shock velocity. (auth)

INSTRUMENTS

5940 AEDC-TR-56-7
Arnold Engineering Development Center, Tullahoma, Tenn.
A METHOD OF CALCULATING THE RESPONSE TIME OF PRESSURE MEASURING SYSTEMS. Robert C. Bauer. Nov. 1956. 33p. Contract AF40(600)-700. (AD-98978).

Theoretical lag-time equations are developed for single- and double-tube pressure measuring systems connected to manometers or constant-volume instruments. Qualifying parameters which relate the equations to a particular system are developed. (T.R.H.)

5941 AERE-EL/M-77
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
APPARATUS FOR MEASURING THE DECREMENT OF TRANSVERSE OSCILLATIONS. M. C. B. Russell and J. C. Boag. Jan. 27, 1953. 10p.

Circuits are described which are suitable for measurement of resonance and damping of transverse oscillations in a specimen. Some notes are given on the performance of piezoelectric crystals as transmitting and receiving elements through wire suspensions. Calculations are included to show the greatest decrement value which can be measured. (auth)

5942 AERE-G/M-131
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
AN ELECTRONIC FLUXMETER. G. F. Snelling and I. A. D. Lewis. May 23, 1952. 8p.

An electronic fluxmeter is described which operates on the integrated current flowing round a search coil circuit. It is designed primarily for use where the magnetic field, of nominally constant magnitude, is repeatedly switched on and off and requires monitoring each time this occurs. Changes of 0.1% in field can be measured provided the build-up time is not more than a few seconds. (auth)

5943 AERE-G/M-142

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE CHARACTERISTICS OF A CORRUGATED WAVE GUIDE WITH A COUPLING HOLE. A. W. Hough-Grassby. Oct. 28, 1952. 8p.

A coupling hole is bored through a partly corrugated X-band slow wave-guide in an attempt to raise the group velocity and lower the attenuation for a given phase velocity. It is shown that the hole does not improve the properties of propagation, but in some circumstances may add the complication of two mode operation. (auth)

5944 AERE-GP/M-155

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A TUNEABLE CAVITY FOR KLYSTRON CV237. P. S. Rogers. July 1953. 9p.

A simple tuneable cavity into which a CV237 klystron may be fitted is described. Thus modified, the valve may be tuned from 8.7 cm to 14.3 cm, with a power output of 100 to 50 mw from 14.3 to 9.7 cm, declining to about 200 mw at 8.7 cm. (auth)

5945 AERE-GP/M-171

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

SOME FEED-BACK CIRCUITS FOR A GROUNDED GRID TRIODE WORKING AT 200 Mc/sec. J. H. Adlam. Mar. 3, 1955. 9p.

Circuits applicable to the grounded-grid triode described in GP/M 159 have been considered. These circuits can be used to neutralize the effect of anode-cathode capacity or to make the tube work as an oscillator. (auth)

5946 CISE-51

Centro Informazioni Studi Esperienze, Milan.

A NEW HALF-WAVE RESPONSE MAGNETIC AMPLIFIER FOR LOW REMANENCE CORES. G. Giannelli and R. Tasselli. June 20, 1956. 5p.

A new type of fast magnetic amplifier is described, that is characterized by a peculiar polarization and the method used for the control of the inductors. This circuit allows the use of low remanence magnetic cores, like the C cut types, besides selenium rectifiers can be made to work at their whole normal inverse voltage rating. (auth)

5947 DP-178

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

A TURBIDIMETER FOR IN-PROCESS ANALYSIS OF ORGANIC CONTAMINATION. Donald W. Colvin. Oct. 1956. 15p. Contract AT(07-2)-1. $0.20(OTS).

A turbidimeter is described which measures organic solvent content in aqueous-organic mixtures up to 1% organic. The probe may be placed in a remote process line. (T.R.H.)

5948

IMAGE DEFECTS IN DOUBLE FOCUSING MASS SPECTROMETERS AND MASS SPECTROGRAPHS. H. Hintenberger and L. A. König. Z. Naturforsch. 12a, 140-7(1957) Feb. (In German)

ISOTOPES

5949

LEAD AND THALLIUM ISOTOPES IN THE MASS RANGE 195-199. Göran Andersson, Edvin Arbman, and Bo Jung (Univ. of Uppsala, Sweden). Arkiv Fysik 11, No. 4, 297-321 (1957).

The following nuclides have been produced by irradiation of Tl in a synchrocyclotron and studied in a β spectrometer: 12.2-min Pb^{199m}, 1.5-hr Pb^{199}, 2.4-hr Pb^{198}, 42-min Pb^{197m}, 37-min Pb^{196}, 17-min Pb^{195m}, 2.7-hr Tl^{197}, 2.4-hr Tl^{196} and Tl^{195}. An electromagnetic isotope separator was used to make mass assignments. All activities except Pb^{199m} seem to decay mainly by electron capture. In addition positron branches probably occur in several cases. Fragmentary decay schemes, supported in part by electron-electron coincidence measurements, have been constructed for the odd mass numbers. A contribution to the knowledge of nuclear level systematics in this region with primary emphasis on the odd mass nuclei is also made. (auth)

5950

A SEARCH FOR VARIATIONS IN THE RELATIVE ABUNDANCE OF THE ZINC ISOTOPES IN NATURE. R. Blix, H. V. Ubisch, and Frans E. Wickman. Geochim. et Cosmochim. Acta 11, 162-4(1957) Mar.

The ratio Zn^{64}/Zn^{66} was studied in 18 samples of 7 different Zn minerals. No variations were detected. If the variations exist, they are less than 1% of the ratio. (auth)

5951

NATURAL VARIATIONS IN THE RELATIVE ABUNDANCES OF THE NITROGEN ISOTOPES. A. Parwel, R. Ryhave, and Frans E. Wickman. Geochim. et Cosmochim. Acta 11, 165-70(1957) Mar.

Two samples of NH_4Cl, two of caliche, eight of Wealden coal, five of Carboniferous coal, three of living trees and one air sample were studied. The NH_4Cl samples formed a distinct group about 1% heavier than the air sample. The other samples showed variations of some parts per thousand from the air sample. The Wealden-coal nitrogen is heavier than the Carboniferous-coal nitrogen, this being contrary to the results found for the carbon isotopes. (auth)

5952

CHLORINE-36 IN PITCHBLENDE. P. K. Kuroda, R. R. Edwards, Berol L. Robinson, J. H. Jonte, and Cleo Goolsby (Univ. of Arkansas, Fayetteville). Geochim. et Cosmochim. Acta 11, 194-6(1957) Mar.

The natural occurrence of Cl^{36} in pitchblende has been established. The specific activity of Cl in Great Bear Lake pitchblende, (4 ± 1) disintegrations per minute per gram of Cl, corresponds to an "apparent thermal neutron flux" of (0.12 ± 0.03) neutrons cm^{-2} sec^{-1}. (auth)

5953

THE DIFFUSION OF FISSION-Xe FROM U METAL. K. E. Zimen and L. Dahl. Z. Naturforsch. 12a, 167-9(1957) Feb. (In German)

5954

ARTIFICIAL RADIOELEMENTS. Distributed by Comissariat a l'Energie Atomique, Boite Postale n° 2, Gif s/ Yvette (Seine-et-Oise). 1957. 137p. (In French)

Facilities and products available from the French Comissariat a l'Energie Atomique are described. Included are information on pile irradiation services; radioisotopes; labeled preparations; irradiation sources available; prices; and regulations governing the handling and shipping of radioactive materials. (C.H.)

ISOTOPE SEPARATION

5955

CONCERNING THE SEPARATION OF ISOTOPES BY SURFACE DIFFUSION IN POROUS MEDIA. W. G. Trawick and A. S. Berman (Oak Ridge Gaseous Diffusion Plant, Tenn.). J. Chem. Phys. 26, 709-10(1957) March.

MASS SPECTROGRAPHY

5956
IONIZATION EFFICIENCY CURVES AND THE STATISTICAL THEORY OF MASS SPECTRA. L. Friedman, F. A. Long, and M. Wolfsberg (Brookhaven National Lab., Upton, N. Y. and Cornell Univ., Ithaca, N. Y.). J. Chem. Phys. 26, 714-15(1957) March.

MATHEMATICS

5957 AECU-3425
Sandia Corp., Albuquerque, N. Mex.
SOME NOTES ON THE ESTIMATION OF RELIABILITY. R. L. Calvert. [Sept. 4, 1956]. 12p. Contract [AT-(29-1)-789]. $3.30(ph OTS); $2.40(mf OTS).

Methods of estimating the reliability of lots of equipment or components are outlined. (B.J.H.)

5958 AECU-3434
[Los Alamos Scientific Lab., N. Mex.]
SUBORDINATION IN COMPLEX VARIABLE THEORY AND A THEOREM ON MINIMAL SURFACES (thesis). John H. Evans. 1955. 15p. Contract [W-7405-eng-36]. $3.30(ph OTS); $2.40(mf OTS).

Submitted to the Univ. of California, Los Angeles.

A definition of subordinate functions is given and theorems concerning them by G. M. Goluzin and E. Reich are stated. A definition of minimal surfaces is stated and a convenient notation for their representation is presented. Then the following theorem is proved of pairs of minimal surfaces whose coordinate functions are subordinate: if f_j and F_j are the coordinate functions of two minimal surfaces given in conformal representation and $f_j < F_j$ then the minimal surfaces are plane surfaces and the F_j surface is a subset of the f_j surface. (auth)

5959 AERE-T/M-144
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
PERTURBATION FORMULAE FOR THE MATHIEU EQUATION. M. Bell. Feb. 1957. 14p.

An approximate expression is derived, using Brillouin-Wigner perturbation theory, for the separation of the a_N and b_N lines of the Mathieu equation stability chart, and for the maximum growth of oscillation in the region between the lines. (auth)

5960
A MINIMUM-MAXIMUM PROBLEM FOR DIFFERENTIAL EXPRESSIONS. D. S. Carter (Los Alamos Scientific Lab., N. Mex.). Can. J. Math. 9, 132-40(1957).

Refer also to abstract 6006.

MEASURING INSTRUMENTS AND TECHNIQUES

5961 AECU-3397
Michigan. Univ., Ann Arbor.
A SIMPLIFIED PHOTOGRAPHIC COINCIDENCE METHOD. Donald G. Gardner and Ronald W. Shideler. 6p. Project No. 7. Contract AT(11-1)-70. $0.15(OTS).

5962 CEA-527
France. Commissariat a l'Énergie Atomique, Paris.
DISPOSITIF DE MESURE DES FORTES SOURCES EMETTRICES GAMMA. (Measuring Device for Strong Gamma-Ray Sources). J. Engelmann and J. Vagner. Feb. 21, 1956. 11p.

An A-filled ionization chamber for measuring gamma intensities from 100 μc to 5 c is described. Sources are introduced into the center of the chamber by remote handling equipment, and intensities are directly registered. (D.E.B.)

5963 DP-197
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
AN ALPHA MONITOR FOR WASTE STREAMS. Edward C. Wingfield. Jan. 1957. 8p. Contract AT(07-2)-1. $0.15(OTS).

A continuous alpha monitor was developed for aqueous streams that may contain traces of radioactivity. A scintillation screen was submerged directly in the water. The instrument detected concentrations as low as 3.3×10^{-10} curie/ml. The monitor's sample cell could be decontaminated easily if background activity accumulated within it. (auth)

5964 LAMS-2100
Los Alamos Scientific Lab., N. Mex.
THE LARGE LIQUID SCINTILLATION DETECTOR AS A NEUTRON SPECTROMETER. Clyde L. Cowan, Jr., and Frederick Reines. Dec. 12, 1956. 5p. Contract W-7405-eng-36. $0.15(OTS).

A general elementary discussion is given on the use of large liquid scintillation detectors as neutron spectrometers. (B.J.H.)

5965 UWFL-46
Washington. Univ., Seattle. Applied Fisheries Lab.
SURVEY OF RADIOACTIVITY IN THE SEA NEAR BIKINI AND ENIWETOK ATOLLS JUNE 11-21, 1956. Lauren R. Donaldson, Allyn H. Seymour, Edward E. Held, Neal O. Hines, Frank G. Lowman, Paul R. Olson, and Arthur D. Welander. July 23, 1956. Decl. Nov. 28, 1956. 39p. Contract AT(45-1)-540. $0.30.

During the period June 11 to 21, 1956, measurements were made of the radiation in plankton, water, and fish samples collected near Bikini and Eniwetok Atolls. A continuous record of the radiation in the surface water was obtained with a probe. Plankton samples from oblique tows to a depth of 200 meters and water samples from the surface and from depths of 25, 50, 75, and 100 meters indicated radioactivity at each station. Data are tabulated. (C.H.)

5966
AN INVESTIGATION ON LATENT IMAGE FADING IN ILFORD G-5 EMULSIONS. Göran Leide (Univ. of Lund, Sweden). Arkiv Fysik 11, No. 4, 329-46(1957).

Fading of individual proton tracks was determined in Ilford G-5 emulsions as a function of time, temperature, relative humidity, and energy loss. The measurements enclose the intervals 0 to 2 months, 3 to 30°C, 13 to 75% RH and 3 to 20 kev/μ ionization loss. A photometric method was used to determine the grain density of individual tracks. The faded tracks were measured in the same emulsion as unfaded comparison tracks. The precautions and corrections needed are discussed. It has been found that the fading is constant in the interior of the emulsion. The fading effect is larger at the surface. The investigation was essentially confined to the constant effect of the interior. Provided that this effect is not too large, the apparent energy absorbed per unit length is diminished by a constant factor independent of the original ionization. The factor depends on the storing conditions. The factor being constant, a faded track will appear as if it were due to a particle lighter than the real one, if compared with unfaded tracks. The apparent mass has been used to characterize the fading and has been given as a function of time, temperature, and relative humidity. The curves give a survey of the progress of fading under different conditions. (auth)

5967

A SOFT VALVE SCALER FOR INTERMITTENT FAST COUNTING. G. W. Hutchinson (Univ. of Birmingham, Eng.). J. Sci. Instr. 34, 109-10(1957) March.

A simple scaling circuit is described in which gas-filled scaling valves are used for counting bursts of radiation without severe counting losses, even when the mean interval between counts within the bursts is much less than the resolving time of the soft valves. To do this, information is stored during the bursts as charge on a condenser and is subsequently read off as a series of evenly spaced pulses by discharging the condenser with a standard repetitive waveform. (auth)

5968

COUNTING THOUSANDS OF SAMPLES IN 12 HOURS — AUTOMATICALLY. Kenneth E. Relf (Westinghouse Electric Corp., Pittsburgh). Nucleonics 15, No. 4, 86-9(1957). Apr.

An automatic counting system is presented where count rates from 2,000 foils are punched on 333 cards, and the computer corrects each of these points for background, decay, and channel-to-channel normalization at the rate of 50 cards/min. Critical buckling, reflector savings, power distributions, and neutron ages can be computed from information provided by plots of neutron distributions in reactors. (W.L.H.)

5969

SEPARATED CHANNELS IMPROVE LIQUID SCINTILLATION COUNTING. Monte Blau (Roswell Park Memorial Inst., Buffalo, N. Y.). Nucleonics 15, No. 4, 90-1(1957) Apr.

The addition of a single switch to the circuit of an existing dual-channel liquid scintillation counter makes it possible to improve separation of isotope pairs with overlapping energy spectra. (W.L.H.)

5970

TEMPERATURE DEPENDENCE OF PHOTOMULTIPLIER GAIN. Frank E. Kinard (E. I. du Pont de Nemours and Co., Inc., Aiken, S. C.). Nucleonics 15, No. 4, 92, 94-7 (1957) Apr.

The gain stability of scintillation counters is discussed as to the ambient temperature effect on the photoelectric efficiency of the photocathode of the photomultiplier, the secondary emission ratio of the dynodes, and the magnitude of the light flash emitted by the crystal. (W.L.H.)

5971

ČERENKOV-PHOTOVOLTAIC MONITOR FOR HIGH-INTENSITY RADIATION. C. C. Thomas Jr., K. H. Sun, and E. A. Marusich (Westinghouse Electric Corp., East Pittsburgh). Nucleonics 15, No. 4, 98-101(1957) Apr.

A high intensity-radiation monitor was developed comprising a Cherenkov cell, photovoltaic detector, and a milliammeter. (W.L.H.)

5972

SPURIOUS SCATTERING IN NUCLEAR EMULSIONS. A. J. Apostolakis, J. O. Clarke, and J. V. Major (Univ. of Durham, Eng.). Nuovo cimento (10) 5, 337-46(1957) Feb.

Spurious scattering has been determined in two emulsion stacks, one exposed to 4.2-Bev π^- mesons from the Berkeley Bevatron and the other to cosmic rays at sea level. In both stacks the mean modulus of the second differences of spurious scattering ($\bar{d}$) varies with cell length (t) as $\bar{d} = at^b$ where b is approximately equal to unity and the constant a is different in the two stacks. In the first stack the spurious scattering is relatively small, and reliable measurements of $p\beta$ have been made at 4.3 Bev/c. In the second stack, spurious scattering is larger than in the π-meson stack and uncorrected measurements of $p\beta$ are reliable only up to about 2.5 Bev/c. The apparent value of $p\beta$ corresponding to the spurious scattering in this stack is about 5 Bev/c. The error on the value of $p\beta$ determined in the presence of spurious scattering is given. (auth)

5973

ON THE RELATION BETWEEN BLOB-DENSITY AND VELOCITY OF A SINGLY CHARGED PARTICLE IN G-5 EMULSION. G. Alexander and R. H. W. Johnston (Dublin Inst. for Advanced Studies). Nuovo cimento (10) 5, 363-79 (1957) Feb.

A calibrated curve is presented expressing grain density as a function of $p\beta c$ for π and μ mesons, and is found to be in good agreement with the Bethe-Bloch formula for "restricted ionization loss." The 2-body decays of K particles were used as monocromatic sources of π and μ mesons. Blob-density measurements were reduced to grain density by means of the O'Ceallaigh theory. A "least squares fit" of the experimental points to the Bethe-Bloch formula, together with the experimental "plateau" point, yielded for the mean ionization potential in AgBr the value (530 ± 100) ev, and for the maximum energy transfer the value $(2.9 \pm 0.5) \times 10^4$ ev. (auth)

5974

THE EFFECT OF ULTRA-VIOLET CONVERTERS ON THE EFFICIENCY OF LIQUID ČERENCOV COUNTERS. N. A. Porter (A.E.R.E., Harwell, Berks., Eng.). Nuovo cimento (10) 5, 526-7(1957) Feb.

Tests were made on the effects of ultraviolet converters in solution in a H_2O-filled Cherenkov counter. Three water-soluble fluorescent materials, Fluorescein, β-Methyl Umbelliferone, and Uvitex, were examined. An increase in mean pulse height of about 100% was observed with slightly alkaline solutions of β-Methyl Umbelliferone. (B.J.H.)

5975

HIGH RESOLUTION BETA SPECTROMETER OF NEW DESIGN. H. Wild and O. Huber. Helv. Phys. Acta 30, No. 1, 3-32(1957). (In German)

For the double-focusing, most luminous spectrometer with the coefficients $\alpha = {}^1/_2$, $\beta = {}^3/_8$ in the field expansion $H(r) = H_0(1 - \alpha\rho + \beta\rho^2 - \gamma\rho^3 \ldots)$ the image equations up to third order are calculated for an extended flat source. Hence follows for the third coefficient γ the value ${}^{43}/_{144}$ for optimum conditions. The calculations for electrons of different impulses showed, that with $\beta = {}^3/_8$ and $\gamma = {}^5/_{16}$ at the same time a whole range of energy can be registered on a film, similar to the semicircular spectrograph. Moveover the double focusing remains independent of the impulse. To reach a high resolution a form for the magnet has been constructed so that no marginal effects arise and not only the fieldstrength, but also the coefficients α and β can be stabilized. (auth)

5976

DELAYS IN PROPORTIONAL COUNTERS. H. C. Hamers, G. J. Sizoo, A Marseille, and Th. J. De Boer. Physica 23, 225-35(1957) Mar.

Delays in proportional counters, filled with A alcohol, A n-pentane, Kr alcohol, Kr n-pentane and Xe n-pentane mixtures, are determined as a function of the voltage on the counters. From these data the values of the electron mobilities are derived in the region of Flp at about 0.1 or 0.2. A discussion in connection with coincidence measurements is given. (auth)

5977

THE BACKGROUND OF COUNTERS AND RADIOCARBON DATING. A. Moljk, R. W. P. Drever and S. C. Curran (Univ. of Glasgow). Proc. Roy. Soc. (London) A239, 433-45 (1957) Apr.

In order to compare the efficiency of different counting

arrangements for radiocarbon dating the use of a factor of merit $M = s_0/\sqrt{b}$, where s_0 is the counting rate from a fresh carbon sample and b the background counting rate, is suggested. In standard low activity equipment with a Geiger or proportional counter surrounded by a ring of Geiger counters in anti-coincidence, the residual background is mainly due to the detection of secondary particles produced in the wall of the counter by uncharged radiations. A new type of proportional counter, in which this wall effect is reduced, is described. The counter is fitted with a ring of internal shielding counters separated only by a number of cathode wires from the main central counter. The operation of this counting equipment is discussed, and it is shown that the background of 2.2 counts/min obtained under normal operating conditions in a sensitive volume of 5.6 l. is due mainly to the absorption of uncharged radiations in the gaseous sample itself. (auth)

5978

CALCULATIONS OF ENERGY DISSIPATION CHARACTERISTICS IN WATER FOR VARIOUS RADIATIONS. P. R. J. Burch (Univ. of Leeds, Eng.). Radiation Research 6, 289-301(1957) Mar.

5979

MEASUREMENT OF THE BRAGG-GRAY STOPPING-POWER CORRECTION. G. N. Whyte (National Research Council, Ottawa, Can.). Radiation Research 6, 371-9(1957) Mar.

5980

A PHOTOGRAPHIC METHOD FOR THE DETERMINATION OF THE ISODOSE CURVES IN RADIO THERAPEUTICS. Walter S. Moos and Glen H. Sandberg. Strahlentherapie 102, 223-7(1957) Feb. (In German)

A photographic-electronic method is described briefly for the instantaneous determination of isodose curves in multiportal radiation therapy. (auth)

5981

VELOCITY OF IRRADIATION WITH Co^{60} TELETHERAPY UNIT. Otto Hubacher. Strahlentherapie 102, 315-33(1957) Feb. (In German)

Refer also to abstract 6140.

MESONS

5982

PHOTOPRODUCTION OF SLOW π^--MESONS ON COMPLEX NUCLEI. E. G. Gorzhevskaya and N. M. Panova (Lebedev Inst. of Physics, Acad. of Science U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 111, 1205-8(1956) Dec. 21. (In Russian)

The process of slow π^--meson photoproduction on complex nuclei was studied to determine whether the process is confined to one nucleon or is of a more complex character. Also, an attempt was made to obtain the data on slow meson interactions with residual nuclei. (R.V.J.)

5983

INTERACTION OF K^+-MESONS WITH EMULSION NUCLEI BETWEEN 40 AND 160 MEV. M. Baldo Ceolin, M. Cresti, N. Dallaporta, M. Grilli, L. Guerriero, M. Merlin, G. A. Salandin, and G. Zago. Nuovo cimento (10) 5, 402-34(1957) Feb.

110 meters of K^+ tracks have been followed in the energy interval from 40 to 160 Mev. The events observed have been classified a) 5 K-H collisions; b) 170 elastic and 91 inelastic scatterings; c) 10 charge exchanges; d) 56 decays in flight. The discrimination between elastic and inelastic scatterings has been made with a statistical method. The events were divided in two energy intervals (40 to 90 Mev) and (90 to 160 Mev) in order to study the variation of the cross section for elastic and inelastic events with the energy. From the analysis of the elastic events, the existence of a repulsive nuclear potential of about 15 Mev was found. This result is in agreement with other features relative to inelastic events. From the analysis of the inelastic events we have tried to obtain some information about the elementary K-nucleon cross section and at present the data seem to indicate that in the energy interval studied, the isotopic state $T = 1$ is predominant, probably as an S wave. In the higher energy interval there is probably a little contribution of a $T = 0$ state as a P wave. (auth)

5984

MESONIC ATOMS: RADIATIVE YIELDS OF THE μ-MESON K AND L SERIES AND THE EFFECT OF MESON CAPTURE IN CHEMICAL COMPOUNDS. Mary Beth Stearns and Martin Stearns (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 105, 1573-82(1957) March 1.

The radiative yields of the K and L series of μ-mesonic atoms have been measured for the elements $_3$Li through $_{19}$K. In the low-Z region both yield curves exhibit a rapid decrease in yield with decreasing Z. This behavior is attributed to competition between Auger and radiative transitions. However, if this is true, the Auger transition probabilities would have to be about 300 times larger than the calculated values for the $\mu-K$ yields, and about 30 times larger for the $\mu-L$ yields. The effect of meson capture by the different elements of a compound has been measured for Al_2O_3 and CaS. For these compounds it is found to be proportional to Z within 10 to 20%, in agreement with the prediction of Fermi and Teller. (auth)

5985

NONRADIATIVE ABSORPTION OF POSITIVE PIONS BY DEUTERONS AT 118 Mev. Charles Erwin Cohn (Univ. of Chicago, Ill.). Phys. Rev. 105, 1582-7(1957) March 1.

The reaction $\pi^+ + d \rightarrow p + p$ was studied at a center-of-mass pion energy of 118 ± 2 Mev, using scintillation counters and a liquid deuterium target. The angular distribution was given by $d\sigma/d\Omega \propto A + \cos^2\theta$, with $A = 0.216 \pm 0.033$, while the total cross section 12.09 ± 0.93 mb. The total cross section for the inverse pion production reaction was calculated from detailed balancing as 3.10 ± 0.24 mb. These results are compared with other work. (auth)

5986

ANGULAR CORRELATIONS IN K^0-DECAY PROCESSES. A. Pais (Inst. for Advanced Study, Princeton, N. J.) and S. B. Treiman (Princeton Univ., N. J.). Phys. Rev. 105, 1616-19 (1957) March 1.

The reactions $K^0 \rightarrow \{e^\pm \text{ or } \mu^\pm\} + \nu + \pi^\mp$ afford a good opportunity to study fully the dynamics of decay processes involving leptons. It is shown that, under certain rather general assumptions customarily adopted in regard to weak lepton interactions, the distribution in angle between π and ν has a simpel, uniquely specified form, independent of the properties of the K particle; namely, aside from a known, angle-dependent factor related to phase volume, the distribution is proportional $A + B\cos\theta + C\cos^2\theta$, where A, B, and C may depend on the π momentum. For any given momentum, the relative magnitudes of A, B, and C, when determined experimentally, can be expected to illuminate a second aspect of the problem; namely, the detailed nature of the lepton coupling. The situation is especially transparent for the e-ν-π mode in the case that the K particle has zero spin. This is discussed in some detail. (auth)

5987

Z DEPENDENCE OF POSITIVE PHOTOPION PRODUCTION. W. S. C. Williams, K. M. Crowe, and R. M. Friedman (Stanford Univ., Calif.). Phys. Rev. 105, 1840-5(1957) Mar. 15.

The Z dependence of positive photopion production has been measured with 550-Mev bremsstrahlung. The data are compared with the optical model using the real and imaginary potentials given by Frank, Gammel, and Watson. If variations in the production cross section due to the real potential, including the Coulomb potential, are taken into account, the agreement for pion energies in the range 33 to 152 Mev is surprisingly good considering both the approximations in the model and the experimental errors. The observed absorption mean free path varies from $\sim 9 \times 10^{-13}$ cm for 33-Mev pions to $\sim 1 \times 10^{-13}$ cm at the highest energies. (auth)

5988

SCATTERING OF K^+ PARTICLES FROM PROTONS AND DEUTERONS. Jeremy Bernstein (Harvard Univ., Cambridge, Mass.). Phys. Rev. 105, 1853-8(1957) Mar. 15.

The direct coupling between K particles and π mesons, proposed by Schwinger, has been used to calculate the scattering of K^+ particles from nucleons and deuterium. It is shown that this interaction gives a reasonable explanation of the observed forward peaking in the angular distribution of K^+ particles scattered from protons. The theory predicts an inhibition of elastic scattering from the deuteron. The energy spectrum for K^+ particles inelastically scattered from deuterium has been calculated assuming a simple model for the deuteron. There are no experiments presently available for deuterium. (auth)

5989

Z DEPENDENCE OF POSITIVE PION PRODUCTION BY 340-Mev PROTONS. William Imhof, Harry T. Easterday, and Victor Perez-Mendez (Univ. of California, Berkeley). Phys. Rev. 105, 1859-62(1957) Mar. 15.

The relative yield of positive pions produced in various elements by the 340-Mev external beam of protons from the 184-in. Berkeley cyclotron was measured using a counter telescope to identify the mesons. The target materials used were Li (normal), Be, B^{10}, B^{11}, C, Al, Cu, Ag, and Pb. Mesons from these elements with energies 36 ± 4 Mev and 63 ± 4 Mev were observed at an angle of 135° relative to the proton beam. The effect of the penetration of the protons into the heavier nuclei on the resultant yield of pions was observed and the result compared with Gasiorowicz's theory. In the lighter nuclei, the effects of the increasing momentum-density distribution from Li to C were noted and approximate 1/e values were obtained for assumed Gaussian momentum distributions. (auth)

5990

CLOUD CHAMBER INVESTIGATION OF ANOMALOUS θ^0 PARTICLES. J. A. Kadyk, G. H. Trilling, R. B. Leighton, and C. D. Anderson (California Inst. of Tech., Pasadena). Phys. Rev. 105, 1862-71(1957) Mar. 15.

Eighteen anomalous θ^0, (θ^0_{anom}), decay events observed in the California Institute of Technology magnet cloud chambers have been analyzed. Many of these decays are dynamically inconsistent with the $\tau^0 \rightarrow \pi^+ + \pi^- + \pi^0$ scheme, but most are consistent with the decay processes: $\theta^0_{\text{anom}} \rightarrow \pi^+ + \pi^- + \gamma$, $\pi^\pm + \mu^\mp + \nu$, and $\pi^\pm + e^\mp + \nu$. However, at least one event is inconsistent with each decay scheme. From the locations of the decays in the cloud chamber, the lifetime is found to be significantly longer than that of the normal θ^0 particle, called here the $\theta^0_{\pi 2}$ particle. Other differences in the behavior of the θ^0_{anom} and $\theta^0_{\pi 2}$ particles were also observed in the (a) momentum distributions, (b) origin locations, (c) relative numbers of θ^0_{anom} and $\theta^0_{\pi 2}$ particles traveling upward, and (d) the types of V particles produced in association with the θ^0_{anom} and $\theta^0_{\pi 2}$. It is concluded that not all the θ^0_{anom} decays can result from alternate decay modes of the $\theta^0_{\pi 2}$. Moreover, many decays can be neither τ^0 decays nor alternate decays of the $\theta^0_{\pi 2}$. The characteristics of the θ^0_2 particle proposed by Gell-Mann and Pais are consistent with those of the θ^0_{anom} particle, with the possible exception of the observed types of associations. An estimate was made of the relative number of θ^0_{anom} to $\theta^0_{\pi 2}$ particles observed to decay in the cloud chamber. If all θ^0_{anom} decays are assumed to arise from decays of the θ^0_2 particle, then a lower limit for the θ^0_2 lifetime is found to be about 10^{-9} sec. (auth)

5991

ISOBARIC NUCLEON MODEL FOR PION PRODUCTION IN NUCLEON–NUCLEON COLLISIONS. S. J. Lindenbaum and R. M. Sternheimer (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 105, 1874-99(1957) Mar. 15.

A detailed quantitative model for pion production via excitation of one or both nucleons to an isobaric state with subsequent decay via pion emission is presented. The model is applied to the 0.8- to 3.0-Bev incident nucleon energy range and its predictions are compared to various experiments in this energy range performed at the Brookhaven Cosmotron. The isobaric state with isotopic spin and angular momentum = $^3/_2$ observed in the pion-nucleon scattering was assumed to be predominantly responsible for pion production in this energy range. The relative probability for isobar formation and subsequent decay with a variable total energy or mass in the isobar rest system were phenomenologically related to the π^+-p interaction cross section. The energy or momentum spectra of pions, and nucleons, the variation of the ratio of double to single production, the angular correlation, and the Q value distribution for pion-nucleon pairs have been calculated at various energies from 0.8- to 3.0-Bev and generally agree with the experimental results. (auth)

5992

PHOTOPRODUCTION OF π^0 MESONS IN HYDROGEN. L. J. Koester, Jr. and F. E. Mills (Univ. of Illinois, Urbana). Phys. Rev. 105, 1900-13(1957) Mar. 15.

Measurements are reported on the total cross section from 150 to 240 Mev of incident photon energy and measurements of the 135° differential cross section from 180 to 215 Mev. A Monte Carlo evaluation of the γ-ray telescope efficiency by means of an electronic digital computer is outlined. The combined results indicate that a small but finite amount of S-state production occurs and that the angular distribution becomes flatter as the energy decreases. The latter effect is associated with production in unenhanced P-states and with a lack of electric quadrupole production. Good agreement with the Chew-Low theory is demonstrated by a comparison between the photoproduction and scattering of π^0-mesons, where the scattering cross sections are derived from those for charged mesons by charge independence. (auth)

5993

REPORT ON LONG-LIVED K^0 MESONS. K. Lande and L. M. Lederman (Columbia Univ., New York) and W. Chinowsky (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 105, 1925-7(1957) Mar. 15.

Experiments which established the existence of a long-lived neutral V particle were continued. An analysis was made of 100 V^0 events and pertinent data are included in graphical form. Evidence is given which shows that these are K-mass particles with decay modes primarily into π e ν and π μ ν, establishes the existence of the $\pi + \pi - \pi^0$ mode, and provides additional evidence for the particle mixture theory. (B.J.H.)

5994

MAGNETIC MOMENT OF THE MU MESON. Hiroshi Suura and Eyvind H. Wichmann (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 105, 1930-1(1957) Mar. 15.

Consideration is given to the radiative corrections to the magnetic moment of the μ meson, assuming that the μ meson is a Dirac particle of spin $\frac{1}{2}$ and coupled to the electromagnetic field in the same way as the electron. (B.J.H.)

5995

MAGNETIC MOMENT OF THE μ MESON. A. Petermann (Inst. for Theoretical Physics, Copenhagen). Phys. Rev. 105, 1931(1957) Mar. 15.

Predictions of the magnetic moment of the μ meson, based on quantum electrodynamics, are briefly discussed. (B.J.H.)

5996

K^+ PRODUCTION IN p-p COLLISIONS AT 3.0 Bev. S. J. Lindenbaum and Luke C. L. Yuan (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 105, 1931-2(1957) Mar. 15.

A counter telescope was used to detect K^+ particles emitted at various angles from H and Cu targets exposed to the 2.95-Bev proton beam of the Cosmotron. The K^+/π^+ ratio observed in H_2 was $1/(200 \pm 70)$ which is lower than the value in Cu by a factor of 25. (B.J.H.)

5997

DOUBLE-PLATE CLOUD-CHAMBER STUDY OF V^0 PARTICLES: CLASSIFICATION AND RELATED RESULTS. Ishwar C. Gupta, W. Y. Chang, and Allen L. Snyder (Purdue Univ., Lafayette, Ind.). Phys. Rev. 106, 141-9(1957) Apr. 1.

Two rectangular cloud chambers have been used independently for the study of V^0 particles. A total of 39 347 pairs of good pictures was obtained, in which there were 3439 penetrating showers. 254 V^0 events have been found in these pictures, of which 129 are shower-associated events. 102 out of these show clear association with nuclear interactions having measurable origins in the first or second plate or in the chamber roof, and have been analyzed according to the $\alpha-\epsilon$ projection procedure supplemented with the ionization values. From the measured angles of the two decay products relative to the V^0 particles, two alternative sets of ionizations of the decay products (for θ^0 and Λ^0 particles) have been obtained with the help of $\alpha-\epsilon$ diagrams and compared with the experimentally estimated ionizations. In the way 39 V events have been classified as due to θ^0 particles, 23 as due to Λ^0 particles, 11 as "non-classified" events, and 13 as anomalous cases. After weighting the individual events for the detection efficiency, the numbers of θ^0 and Λ^0 particles are found to be 106 ± 31 and 52 ± 18, respectively. Distributions of the noncoplanarity angles show that both θ^0 and Λ^0 decays are most probably of the two-body type. The angular distribution of the decay products of θ^0 particles in the rest system indicates a spin higher than 0 for θ^0 particles. (auth)

5998

MEAN LIFE OF K^- MESONS AND THEIR CROSS SECTION IN HYDROGEN. Bruce Cork, Glen R. Lambertson, Oreste Piccioni, and William Wenzel (Univ. of California, Berkeley). Phys. Rev. 106, 167-8(1957) Apr. 1.

Observations were made of the K^- mesons which are present in the Bevatron beam. A 62-in. long liquid H target was used to measure the K^--p cross section. The cross section as computed from observed transmissions was found to be $\sigma_T = 52 \pm 9$ mb. The mean life of the K^- meson was calculated to be $(14.9 \pm {}^{2.2}_{2.4}) \times 10^{-9}$ sec. (B.J.H.)

5999

MESIC ATOMS. D. D. Ivanenko and G. E. Pustovalov. Uspekhi Fiz. Nauk 61, 27-43(1957) Jan. (In Russian)

Mesic atom specific pecularities are reviewed as to the following: proximity to the nucleus, the potential possibilities of meson capture by the nucleus, meson interactions with nucleons, the simultaneous presence of various particles (electrons and mesons) in the nuclear orbit, and various mesonic spins, etc. The effects of various nuclear and μ-meson properties on the energy value in $2P \rightarrow 1S$ transitions of μ-mesonic atoms in Ta and Pb and the scheme of the installation for investigations of the mesonic atom spectra are described. The energy levels of Pb and Sb μ mesons, various curves of the charge density in the nucleus and the corresponding energy levels of Pb μ meson are presented in graphical form. The vacuum polarization in mesic atoms and π-meson interactions with nucleons are analyzed. (R.V.J.)

Refer also to abstracts 5990 and 6138.

METEOROLOGY

6000 ANL-5592

Argonne National Lab., Lemont, Ill.

FIVE-YEAR CLIMATOLOGICAL SUMMARY, JULY 1949–JUNE 1954, [TAKEN AT] ARGONNE NATIONAL LABORATORY, DU PAGE COUNTY, ILLINOIS. Harry Moses and Jack H. Willett. 392p. Contract W-31-109-eng-38. $1.75(OTS).

This five-year climatological summary of the Argonne National Laboratory area includes data based on measurements of wind, temperature, relative humidity, precipitation, solar radiation, atmospheric pressure, soil temperature, and atmospheric stability. A brief description is included of the instruments used, their elevation with respect to the ground, and the length of record used. Tabulated data are presented. Data are compared with data for Chicago. (C.H.)

6001 HW-47721

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

METEOROLOGY AS RELATED TO WASTE DISPOSAL AND WEAPONS TESTS. (Lecture Delivered to AFSWP Personnel, January 15, 1957). J. J. Fuquay. Jan. 15, 1957. 33p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

MOLECULAR PROPERTIES

6002 NP-6246

New York. State Univ. Coll. of Ceramics, Alfred. DIFFUSION IN IONIC COMPOUNDS. A Review. T. J. Gray, B. D. James, and E. A. Giess. Mar. 1957. 93p. Project No. R355-20-18. Contract AF18(600)-1448.

The nature of the defect solid state and diffusion theories are reviewed. Methods for studying diffusion receive special treatment. (T.R.H.)

6003

COMPARISON OF METHODS FOR COMPUTING BOND ORDERS AND ELECTRON DENSITIES. John G. Burr, Jr. (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 26, 431-4(1957) March.

The molecular orbital energy levels, charge distributions, and mobile bond orders for o-, m-, and p-toluidine in the ground state have been evaluated by three procedures: (1) the simple semiempirical LCAO with neglect of overlap; (2) the semiempirical LCAO method with one cycle of self-consistency iteration; (3) the semiempirical LCAO with inclusion of overlap integrals. It is observed that all three methods give closely similar values for the bond orders and charge distribution, and it is thus concluded that the simple method is as adequate to obtain these quantities as any of the refined methods. The dependency on the nitrogen Coulomb parameter of the total pi-electron energy, of the energy of highest occupied orbital, of the charge distribu-

tion, and of the dipole moment for o-toluidine are reported and compared with the first-order perturbation predictions. These calculations were accomplished on the Oak Ridge electronic computer, ORACLE. (auth)

6004

OBSERVATION OF CHEMICAL SHIELDING AND SPIN COUPLING OF C^{13} NUCLEI IN VARIOUS CHEMICAL COMPOUNDS BY NUCLEAR MAGNETIC RESONANCE. C. H. Holm (Shell Development Co., Emeryville, Calif.). J. Chem. Phys. 26, 707-8(1957) March.

NEUTRONS

6005 KAPL-M-BES-1

Knolls Atomic Power Lab., Schenectady, N. Y.

ELEMENTARY THEORY OF THE PULSED NEUTRON TECHNIQUE IN REACTOR PHYSICS. B. E. Simmons. Oct. 8, 1956. 17p. Contract W-31-109-Eng-52. $3.30 (ph OTS); $2.40 (mf OTS).

A simple theory of the pulsed neutron technique is outlined. This technique consists of injecting a short burst of neutrons into a medium and observing the subsequent flux behavior. (B.J.H.)

6006

AN APPROXIMATE EXPRESSION OF GREEN'S FUNCTION IN THE KINETIC EQUATION OF NEUTRONS. Khr. Ya. Khristov. Doklady Akad. Nauk S.S.S.R. 111, 1197-1200 (1956) Dec. 21. (In Russian)

6007

RESONANCE ESCAPE PROBABILITY IN SLAB LATTICES. Noel Corngold (Brookhaven National Lab., Upton, N. Y.). J. Nuclear Energy 4, 293-304(1957) Mar.

The slowing down of neutrons in a lattice consisting of alternate slabs of noncapturing moderator and nonmoderating fuel whose cross sections vary arbitrarily with energy is studied. The Boltzmann equation is transformed to an integral equation into which appropriate boundary conditions are incorporated. Expansion of the flux functions in terms of orthogonal polynomials in space and angle coordinates yields an infinite set of coupled integral equations in energy. In the simplest approximation and for a hydrogen moderator these equations are easily integrated to give an expression for the resonance escape probability identical with the one recently derived from quite different considerations. It is shown that higher-order terms in our equations should contribute little to neutron absorption in those capture resonances which contribute most to the integrated capture probability. Thus, while our simplest approximation is not a good one for determining flux distributions, it will be quite good for determining resonance escape probabilities. (auth)

6008

THE MACROSCOPIC SCATTERING OF NEUTRONS. AN APPROXIMATION METHOD. J. Yvon. J. Nuclear Energy 4, 305-18(1957) Mar. (In French)

In the diffusion of monoenergetic neutrons the angular distribution of the velocities can be discontinuous, as in the case of neutrons crossing the boundary between a scattering medium and vacuum. In this paper a method is presented which is appropriate to this type of problem and consists in taking from the start a different analytical expression in the two angular regions on both sides of the discontinuity. This method is particularly suited to problems with plane symmetry. It is tested in the case of the Milne problem. (auth)

6009

INELASTIC SCATTERING OF FISSION NEUTRONS IN URANIUM. R. C. Bhandari and R. D. Jain (Atomic Energy Establishment, Bombay, India). J. Nuclear Energy 4, 326-8(1957) Mar.

Energy distribution of inelastically scattered neutrons in U, based on various models of a nucleus, has been considered. An approximate comparison with the neutron spectrum in the fast reactor, EBRI, shows that nuclear level density calculated on the assumption of a degenerate Fermi-Dirac gas gives the best fit. (auth)

Refer also to abstract 5802.

NUCLEAR PHYSICS

6010 CEA-519

France. Commissariat a l'Energie Atomique, Paris.

ADDITIFS ET CORRECTIFS AUX COMMUNICATIONS PRESENTEES PAR LA FRANCE A LA CONFERENCE DE GENEVE D'AOUT 1955. (ADDITIONS AND CORRECTIONS TO THE COMMUNICATIONS PRESENTED BY FRANCE AT THE GENEVA CONFERENCE OF AUGUST, 1955.) Feb. 1956. 16p.

Corrections and additions are given for papers on the measurement of atmospheric radioactivity and pollution in the neighborhood of an atomic center; the measurement of effective slow neutron cross sections of fissile nuclei; and, a study of the energy variation of the effective fast neutron fission cross sections of U^{233}, U^{235}, and Pu^{239}. (B.J.H.)

6011

ON THE CALCULATION OF THE EFFECTIVE ABSORPTION CROSS SECTIONS OF HIGH-ENERGY PARTICLES BY NUCLEI. Georges Philbert. Compt. rend. 244, 1634-6(1957) Mar. 18.

The experimental data on the division of proton charge in nuclei allow the calculation of effective absorption cross sections of high-energy particles. The basic hypotheses are discussed and the numerical results relative to some light and heavy nuclei are presented. (tr-auth)

6012

SOME REMARKS ON PROCEDURES FOR THE ANALYSIS OF EXPERIMENTAL DATA ON NUCLEAR PARAMAGNETIC ABSORPTION. R. A. Zhitnikov (Kazan State Pedagogical Inst.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 20, 1215-19(1956) Nov. (In Russian)

Analysis is made of the work of F. Bloch (Phys. Rev. 70, 460(1946)) data on the feasibility of adapting the radiofrequency nuclear paramagnetic resonance for the isotopic determinations of specimens. (R.V.J.)

6013

ON THE PROPERTIES OF SPIN 2 PARTICLES. T. Regge (Univ. of Rochester, N. Y.). Nuovo cimento (10) 5, 325-36 (1957) Feb.

A theory of spin 2 particles has been worked out. The wave equations are of first order, and a symbolic approach which is developed permits easy computation of quantities of physical interest. An interesting application of the sum rules for spin 2 particles is the calculation of the Coulomb scattering in relativistic Born approximation. The theory is also applied to calculate the decay of a spin 2^+ particle into three pseudoscalar particles and into two Dirac particles. The bearing of the decay calculations on the spin 2^+ hypothesis for the K meson is discussed. (auth)

6014

NUCLEON-NUCLEUS INTERACTION FROM THE STATISTICAL MODEL. E. E. Frahn (National Physical Research Lab., C.S.I.R., Pretoria). Nuovo cimento (10) 5, 393-401 (1957) Feb.

The statistical nuclear model with exchange forces leads to a non-local interaction between a nucleon and its neigh-

bors in nuclear matter ("Van Vleck-potential"). The implications of this interaction with regard to the modification of nuclear motion and to the energy dependence of the real parts of the optical model parameters are examined. Finally, a derivation of Van Vleck's potential is given from Brueckner's coherent model. (auth)

6015

RADIATIVE CORRECTIONS TO PAIR ANNIHILATION. Isadore Harris and Laurie M. Brown (Northwestern Univ., Evanston, Ill.). Phys. Rev. 105, 1656-61(1957) March 1.

The e^6 corrections to the probability of direct two-photon pair annihilation are obtained by applying the substitution law to the Compton scattering radiative corrections. General results are given, as well as low- and high-energy limits. Divergence of the corrected matrix element for small relative velocity, due to failure of the Born approximation, is removed by a more accurate treatment of Coulomb effects based on the Sommerfeld factor. The results are applied to the singlet ground state of positronium, yielding an increase in the lifetime of 0.59%. (auth)

6016

PARITY NONCONSERVATION AND A TWO-COMPONENT THEORY OF THE NEUTRINO. T. D. Lee (Columbia Univ., New York) and C. N. Yang (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 105, 1671-5(1957) March 1.

A two-component theory of the neutrino is discussed. The theory is possible only if parity is not conserved in interactions involving the neutrino. Various experimental implications are analyzed. Some general remarks concerning nonconservation are made. (auth)

6017

SOLUTION OF THE NUCLEAR MANY-BODY PROBLEM. K. A. Brueckner (Univ. of Pennsylvania, Philadelphia) and J. L. Gammel (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 105, 1679-81(1957) March 1.

A brief summary is given of the numerical solutions to the nuclear many-body problem obtained using IBM 704 fast electronic computers. (B.J.H.)

6018

NUCLEAR EMULSION EVIDENCE FOR PARITY NONCONSERVATION IN DECAY CHAIN $\pi^+ - \mu^+ - e^+$. Jerone I. Friedman and V. L. Telegdi (Univ. of Chicago, Ill.). Phys. Rev. 105, 1681-2(1957) March 1.

Nuclear emulsion pellicles were exposed to the π^+ beam of the University of Chicago synchrocyclotron, and over 1300 complete $\pi - \mu - e$ decays were recorded. The relationship of these results to parity nonconservation is briefly discussed. (B.J.H.)

6019

CONFIGURATIONAL MIXING IN β-DECAY THEORY. R. J. Blin-Stoyle and C. A. Caine (Clarendon Lab., Oxford, Eng.). Phys. Rev. 105, 1810(1957) Mar. 15.

It is shown that the deviations of log ft values from those predicted by the single-particle model in the β decay of odd-A nuclei can be accounted for in terms of simple interconfigurational mixing. (auth)

6020

BREMSSTRAHLUNG SPECTRA CORRECTED FOR MULTIPLE SCATTERING IN THE TARGET. E. Hisdal (Univ. of Oslo, Blindern, Norway). Phys. Rev. 105, 1821-6(1957) Mar. 15.

The spectral distribution in the forward direction of bremsstrahlung from a platinum target is evaluated for some typical cases, taking into account the multiple scattering of the incident electrons in the target. It is found that the proportion of high-energy photons is larger than in Schiff's intrinsic integrated spectrum. Tables are given of the correction factors to be applied to Schiff's spectrum for some typical target thicknesses and electron energies from 10 to 300 Mev. For incident electrons of energies 10 to 70 Mev it is found that the intrinsic differential spectrum for $\varphi = 0$ gives a better approximation to the spectrum corrected for multiple scattering than the integrated spectrum does. (auth)

6021

PROTON BREMSSTRAHLUNG. Behram Kursunoğlu (Turkish General Staff, Ankara). Phys. Rev. 105, 1846-53(1957) Mar. 15.

The differential cross section for the production of gamma rays from the bremsstrahlung of protons of 30- to 140-Mev kinetic energy in the center-of-mass system is calculated. An energy-dependent complex square well is used to represent the nuclear interaction. The complexity of the potential enhances gamma-ray production. Furthermore, the theory predicts a low intensity for high-energy gamma rays. It is also found that the continuous spectrum of radiation is closed between very low-frequency and high-energy gamma rays of energy just below the incident proton kinetic energy. By using the experimental information, a qualitative result about the energy dependence of the imaginary part of the potential is obtained in comparable form with those used by other people. (auth)

6022

ANGULAR DISTRIBUTIONS OF POSITRONS FROM $\pi^+ - \mu^+ - e^+$ DECAYS OBSERVED IN A LIQUID HYDROGEN BUBBLE CHAMBER. A. Abashian, R. K. Adair, R. Cool, A. Erwin, J. Kopp, L. Leipuner, T. W. Morris, D. C. Rahm, R. R. Rau, A. M. Thorndike, and W. L. Whittemore (Brookhaven National Lab., Upton, N. Y.) and W. J. Willis (Yale Univ., New Haven, Conn.). Phys. Rev. 105, 1927-8(1957) Mar. 15.

One-hundred-Mev π^+ mesons, produced by bombarding a Cu target with 1-Bev protons in the Cosmotron, were selected by magnetic analysis and directed into a liquid H bubble chamber. The electron angular distribution from μ^+ decay and the μ^+ angular distribution from π^+ decay are shown graphically. The results are compared to those predicted by theory. (B.J.H.)

6023

ANNIHILATION OF POSITRONS IN LIQUID HELIUM. D. A. L. Paul and R. L. Graham (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev. 106, 16-18(1957) Apr. 1.

It has been shown experimentally that positron annihilation in liquid helium exhibits three components of lifetime. At 4.2°K and one atmosphere pressure the longest lived component has a mean life of $(9.1 \pm 0.5) \times 10^{-8}$ sec, an intensity ~ 13%, and has been shown experimentally to arise from $1\,^3S_1$ positronium. The predominant intermediate component has a mean life of $(1.83 \pm 0.15) \times 10^{-9}$ sec at the same temperature and pressure and displays approximately the same fraction of three-quantum annihilations which one expects from free positron annihilation. The shortest component ($\sim 2 \times 10^{-10}$ sec) is weak and is partially masked experimentally by annihilation in source materials. It would appear to arise from $1\,^1S_0$ positronium. (auth)

6024

ANNIHILATION OF POSITRONS IN LIQUID HELIUM. Jerry Wackerle and Robert Stump (Univ. of Kansas, Lawrence). Phys. Rev. 106, 18-20(1957) Apr. 1.

The annihilation scheme of positrons in liquid helium at 4.2°K was studied. Three components in the decay were observed with mean lives: $\tau_1 < 5 \times 10^{-10}$ sec, $\tau_2 = (2.6 \pm 0.2) \times 10^{-8}$ sec, and $\tau_3 = (1.2 \pm 0.2) \times 10^{-7}$ sec. The abundance of the τ_3 component is (16 ± 2)% of all positrons which annihilate in the liquid. Three-quantum annihilation occurs in about 15% of all positron annihilations. This leads to the

conclusion that the three components are due to parapositronium, free positron annihilation, and orthopositronium. (auth)

6025

THEORY OF HIGH-ENERGY BREMSSTRAHLUNG AND PAIR PRODUCTION IN A SCREENED FIELD. Haakon Olsen (Cornell Univ., Ithaca, N. Y.), L. C. Maximon (Brown Univ., Providence, R. I.) and Harald Wergeland (Norges Tekniske Høgskole, Trondheim, Norway). Phys. Rev. 106, 27-46(1957) Apr. 1.

The differential cross sections for high-energy bremsstrahlung and pair production in a screened Coulomb field are calculated without the use of the Born approximation. It is shown that for pair production the correction to the Born approximation occurs only for momentum transfers q of order mc, for any amount of screening. For bremsstrahlung, however, the correction is only important for q's of order $(mc^2/E)mc$, where E is the energy of the electron. As in the case of no screening, the correction to the differential cross section for bremsstrahlung is found to be given by a factor multiplying the Bethe-Heitler cross section. It is then shown that the bremsstrahlung cross section integrated over the angles of the final electron is additive, just as in the case of pair production: one part is the Bethe-Heitler cross section including screening; to this is then added the Coulomb correction which is independent of screening. The cross sections are evaluated by using wave functions which are accurate in the region in space which contributes significantly to the matrix element. This region is determined by the order of magnitude of q, and different wave functions must be used in the regions (I) corresponding to q's of order mc and (II) corresponding to q's of order $(mc^2/E)mc$. In (I) the wave functions are obtained by an expansion in partial waves and use of a WKB method on the radial wave equation. In (II) a WKB technique is used on the three-dimensional wave equation itself. Corrections due to the use of Sommerfeld-Maue wave functions, which are solutions to the second-order Dirac equation, are shown to be negligible. Finally, the method is used to obtain the cross section for small-angel elastic scattering. (auth)

6026

POLARIZATION OF NUCLEI BY RESONANCE SATURATION IN PARAMAGNETIC CRYSTALS. C. D. Jeffries (Univ. of California, Berkeley). Phys. Rev. 106, 164-5(1957) Apr. 1.

It is pointed out that in many cases the saturation of certain so-called forbidden transitions in paramagnetic resonance will also produce a nuclear polarization. This polarization method is particularly appropriate for the determination of the hfs of short-lived nuclei. (B.J.H.)

6027

γ-RAY ANISOTROPY OF Co^{60} NUCLEI POLARIZED BY PARAMAGNETIC RESONANCE SATURATION. M. Abraham, R. W. Kedzie, and C. D. Jeffries (Univ. of California, Berkeley). Phys. Rev. 106, 165-6(1957) Apr. 1.

The method for the polarization of nuclei by the saturation of certain forbidden transitions in paramagnetic resonance was successfully applied to 5.3-yr Co^{60} contained in a single crystal of $La_2Mg_3(NO_3)_{12}.24D_2O$. The paramagnetic absorption in Co^{59} and the γ ray anisotropy of Co^{60} are shown as a function of magnetic field. (B.J.H.)

6028

K^0 DECAY MODES AND THE QUESTION OF TIME REVERSAL OF WEAK INTERACTIONS. R. Gatto (Univ. of California, Berkeley). Phys. Rev. 106, 168-9(1957) Apr. 1.

The possible existence of weak interactions in which invariance under time reversal is violated, is briefly discussed. It is shown that, if weak interactions are assumed to be invariant under time reversal, the long-lived component of the K^0 mixture must never decay into 2 pions and that its branching ratio for decay into $e^-\pi^+\nu$ and $e^+\pi^-\nu$ must be unity. (B.J.H.)

6029

CHARGE ASYMMETRIES IN THE DECAY OF LONG-LIVED NEUTRAL K-MESONS. H. W. Wyld, Jr., and S. B. Treiman (Princeton Univ., N. J.). Phys. Rev. 106, 169-70(1957) Apr. 1.

The implications entailed by the existence of charge asymmetries in the decay of long-lived K^0 mesons are briefly discussed. It is concluded that if such charge asymmetries exist either there are two different K mesons or time-reversal invariance does not hold. (B.J.H.)

6030

THEORY OF μ-MESON DECAY WITH THE HYPOTHESIS OF NONCONSERVATION OF PARITY. Claude Bouchiat and Louis Michel. Phys. Rev. 106, 170-2(1957) Apr. 1.

Theoretical computations are given of μ-meson decay rates. The possibility of nonconservation of parity is included in the calculations. (B.J.H.)

6031

PROTON POLARIZATION IN (d,p) REACTIONS. J. Sawicki (Univ. of Warsaw, Poland). Phys. Rev. 106, 172(1957) Apr. 1.

Errors in previous calculations of proton polarization in (d,p) reactions are discussed. (B.J.H.)

6032

DIRAC PARTICLES IN ARBITRARY EXTERNAL ELECTROMAGNETIC FIELDS. K. M. Case (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 106, 173-4(1957) Apr. 1.

The extent to which it is possible to give a rigorous description of the behavior of polarized Dirac particles in an external electromagnetic field is briefly discussed. (B.J.H.)

6033

NEUTRONS AND NUCLEAR STRUCTURE. D. J. Hughes (Brookhaven National Lab., Upton, N. Y.). Physica 22, 994-1008(1956).

In the past few years slow neutron spectrometers of greatly improved resolving power have been developed at many laboratories throughout the world. During the same period advances in techniques of data analysis have aided in producing the information now available on hundreds of neutron resonances. The manner in which the parameters of these resonances give valuable information on nuclear structure will be described. The experimental findings will be reviewed and particular emphasis paid to their bearing on current theoretical nuclear models. The following aspects will be emphasized: the radiation widths of nuclear energy levels and their relationship to theoretical transition probabilities; the size distributions of neutron widths of levels and recent theoretical treatments of these distributions; the average spacings of levels for different nuclei as well as the apparent non-random distribution of spacings for individual nuclei; the probability of compound nucleus formation, or strength function, compared to recent calculations based on the cloudy crystal nuclear model; and, recent determinations of the nuclear radius at high and low neutron energies. (auth)

6034

ASYMMETRY OF THE POSITRON EMISSION BY POLARIZED ^{58}Co-NUCLEI. H. Postma, W. J. Huiskamp, A. R. Miedema, M. J. Steenland, H. A. Tolhoek, and C. J. Gorter. Physica 23, 259-60(1957) Mar.

NUCLEAR PROPERTIES

6035 AERE-N/M-64

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A SUMMARY OF THE CROSS-SECTIONS OF EXO-ERGIC

NUCLEAR REACTIONS INVOLVING LIGHT NUCLEI. F. Hirst. Nov. 20, 1953. 34p.

Cross-sections for exoergic particle reactions occurring with light nuclei, up to and including Li^7, are given. A brief note regarding the angular distribution is also given for each case when available. Separate tables of references used in collecting the cross-section and angular distribution information are listed. (auth)

6036 CRRP-659(Add.)

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

ADDENDUM TO [CALCULATED CROSS SECTIONS OF IRRADIATED FISSION PRODUCTS]. D. G. Hurst. [1956]. 2p. (AECL-346(Add.)).

Neutron cross section data are given for the nuclides, U^{234}, U^{236}, and Pu^{242}, which are produced by neutron capture in fissile material. (B.J.H.)

6037

MEASUREMENTS OF THE GAMMA RADIATIONS FROM Br^{82} BY THE METHOD OF EXTERNAL CONVERSION. Sölve Hultberg and Arne Hedgran (Nobel Inst. of Physics and Inst. of Radiophysics, Stockholm). Arkiv Fysik 11, No. 4, 369-77(1957).

The γ emission following the decay of Br^{82} has been investigated. The energies of the rays have been accurately determined and their intensities estimated. A calculation of the theoretical dosage rate in roentgens/(hour · mC) at 1 cm in air from the energy and intensity data gives very good agreement with an experimental value from 4π GM counter and $\beta\gamma$-coincidence measurements. (auth)

6038

SCATTERING OF FAST NEUTRONS ON He IN THE ENERGY RANGE OF 2.61 TO 4.09 Mev. H. R. Striebel and P. Huber. Helv. Phys. Acta 30, No. 1, 67-84(1957). (In German)

Relative differential scattering cross sections for neutrons on He^4 have been measured at nine neutron energies between 2.61 and 4.09 Mev. Using an ionization chamber, the energy distributions of the recoiling He nuclei were observed with a 49-channel pulse height analyzer, which is briefly described. The wall effect was reduced to a few percent by using collimated neutrons, an anticoincidence method, and by the addition of argon to the chamber gas. The cross sections and the phase shifts are in good agreement with the predictions from results of the p-He scattering. (auth)

6039

INVESTIGATION OF PROTON MAGNETIC RESONANCE. N. M. Pomerantsev. (Lomonosov Moscow State Univ.). Izvest Akad. Nauk S.S.S.R. Ser. Fiz. 20, 1238-44(1956) Nov. (In Russian)

A high-frequency generator designed for experimental observation of nuclear magnetic resonance signals when the specimens are placed directly into the generator contour-coil is described. Studies were made of the auto-oscillation system of nuclear magnetic resonance and it was shown that the oscillation amplitude of such a system was modulated by the signal v(t), and the frequency of the signal $\omega(t)$. The time of relaxation was determined by measuring the amplitudes of the absorption signal first and second extremum. A method is offered for defining the effective heterogeneity of magnetic fields in the specimen volume based on the time relaxation measurements in specimens with various ion concentrations in paramagnetics. (R.V.J.)

6040

FREQUENCY DEPENDENCE OF PROTON SPIN RELAXATION IN AQUEOUS SOLUTIONS OF PARAMAGNETIC IONS. A. W. Nolle and L. O. Morgan (Univ. of Texas, Austin). J. Chem. Phys. 26, 642-8(1957) March.

Magnetic resonance relaxation times T_1 and T_2 were measured for protons in aqueous solutions of $Cr(H_2O)_6^{+++}$, $Mn(H_2O)_x^{++}$, $Co(H_2O)_x^{++}$, and $Nd(H_2O)_x^{++}$ in the frequency range 2.7 to 28.7 Mc/sec. T_1 was observed to decrease with decreasing frequency for the first two ions, but not the last two, while T_2 was essentially constant for each ion. The abnormally large values of T_1/T_2 which have been previously reported appear as a result of the effect at high frequencies. Those observations are interpreted in terms of a theoretical model of the magnetic interaction between ion and proton in which a random thermal process is presumed to occur with a characteristic correlation time, τ_e, of 10^{-8} to 10^{-11} sec. (auth)

6041

ELECTRIC QUADRUPOLE INTERACTIONS OF DEUTERONS AND MOLECULAR MOTION IN $Li_2SO_4 \cdot D_2O$. S. Ketudat and R. V. Pound (Harvard Univ., Cambridge, Mass.). J. Chem. Phys. 26, 708-9(1957) March.

6042

THE NEUTRON FISSIONABILITY OF U-239 AND Th-233. P. R. Fields, G. L. Pyle, and W. C. Bentley (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 2, 33-7 (1957) Feb.

The thermal neutron fissionability of U^{239} and Th^{233} were measured in the MTR. An upper limit of 20 b was found for the thermal neutron fission cross sections of these two isotopes. (auth)

6043

RADIATION FROM NEUTRON-ACTIVATED SLABS AND CYLINDERS. W. B. Lewis (Phillips Petroleum Co., Idaho Falls). Nucleonics 15, No. 4, 84-5(1957) Apr.

A method is presented for evaluating the activity by the ratio of the amount of radiation leaving the surface to the total amount induced in the object. (W.L.H.)

6044

DIRECTIONAL CORRELATION OF THE 0.845 AND 1.24 MeV γ-RAYS OF ^{56}Fe. G. Bertolini, E. Lazzarini, and M. Mandelli Bettoni. Nuovo cimento (10) 5, 356-62(1957) Feb.

The directional correlation of the 0.845 and 1.24 Mev γ-γ cascade of the Fe^{56} in coincidence with the β^+ spectrum of 1.5-Mev maximum energy has been studied. The observed correlation function, after correction for the finite angular resolution of the detectors, is given by $W(\theta) = 1 + (0.1023 \pm 0.0027)P_2(\cos\theta) + (0.0015 \pm 0.0035)P_4(\cos\theta)$ according to a spin and multipolarity assignment 4(2)2(2)0. (auth)

6045

EFFECTIVE NUCLEAR POTENTIALS. W. E. Frahn and R. H. Lemmer (National Physical Research Lab., C.S.I.R., Pretoria, South Africa). Nuovo cimento (10) 5, 523-5(1957) Feb.

Results of calculations of nuclear potentials are summarized. (B.J.H.)

6046

THE INTERPRETATION OF THE LEVELS OF ^{19}F ON THE ROTATIONAL MODEL. E. B. Paul (Atomic Energy Research Establishment, Harwell). Phil. Mag. (8) 2, 311-16 (1957) Mar.

6047

CORRELATIONS BETWEEN THE NEUTRON MULTIPLICITIES AND SPONTANEOUS FISSION MODES OF CALIFORNIUM-252. Donald A. Hicks, John Isle, Jr., Robert V. Pyle, Gregory Choppin, and Bernard Harvey (Univ. of California, Berkeley). Phys. Rev. 105, 1507-11(1957).

The numbers of prompt neutrons associated with specific fission modes of Cf^{252} have been measured. The average number of neutrons per fission depends largely upon the total kinetic energy of the fission fragments, decreasing by

at least 0.06 neutron per fission for an increase of 1 Mev in the total kinetic energy. A less marked variation with the ratio of fragment masses is observed. (auth)

6048

NEUTRON EMISSION FROM FISSION MODES. R. B. Leachman and C. S. Kazek, Jr. (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 105, 1511-13(1957) March 1.

The number and energy of neutrons and the average energy of prompt gamma rays emitted from various fission modes are estimated from the excitation-energy distributions of fragments from these modes. These excitation-energy distributions are derived from the mass equation of fission and the measured kinetic energies of the fragments. Simple considerations of neutron boil-off are used with these excitations. For the most probable mass ratios of fragments, the variation in the average number of neutrons $\bar{\nu}$ with the total kinetic energy E_K of the fragments is found to be $d\bar{\nu}/dE_K = 0.121$ Mev^{-1} for thermal-neutron fission of U^{235} and -0.116 Mev^{-1} for spontaneous fission of Cf^{252}. The spectra of neutron energies resulting from this analysis are found to have negligible change with E_γ, but the neutrons from Cf^{252} fission are more energetic than those from thermal neutron fission of U^{235}. The average energy E_K of prompt gamma rays from Cf^{252} fission is found to be 4.0 Mev, with a variation $dE_\gamma/dE_K = -0.0167$ for the most probable mass ratios of fragments. (auth)

6049

BETA DECAY AND ELECTRON CAPTURE BRANCHING TO THE LEVELS OF Pu^{239}. Jack M. Hollander (Univ. of California, Berkeley). Phys. Rev. 105, 1518-20(1957) March 1.

The experimental log ft values of the Np^{239} beta decay and Am^{239} electron capture are analyzed according to the asymptotic selection rules proposed by Alaga for deformed nuclei. It is found that, with a reasonable choice of state assignments from the Nilsson energy level diagram, a consistent interpretation can be given of the observed logft values. All "allowed" transitions are retarded by a least an order of magnitude, whereas the "first forbidden" transitions observed here proceed with normal ft values. The interesting case of an "allowed" transition with log ft > 8 is discussed. (auth)

6050

DECAY OF Ir^{192}. Vincent Shiel, L. D. Wyly, and C. H. Braden (Georgia Inst. of Tech., Atlanta). Phys. Rev. 105, 1521-4(1957) March 1.

Gamma-gamma angular correlation experiments have been performed for the 604−316, 588−613, and 468−316 kev cascades in Pt^{192} and the 485−206 kev cascade in Os^{192}. The data are consistent with a spin of 3 for the 690-kev level in Os^{192} and the 921- and 1201-kev levels in Pt^{192}. The assignment of spin 3 to the 1201-kev level in Pt^{192} requires an admixture of about 8.5 percent M1 radiation in the 588-kev transition. Spin 5 for the ground state of Ir^{192} is indicated. (auth)

6051

INTERNAL CONVERSION ELECTRONS FOLLOWING COULOMB EXCITATION OF HIGHLY DEFORMED NUCLEI. E. M. Bernstein and H. W. Lewis (Duke Univ., Durham, N. C.). Phys. Rev. 105, 1524-8(1957) March 1.

A study of internal conversion electrons following Coulomb excitation by alpha particles of a number of nuclei in the rare earth region has been made. In four cases, Eu^{153}, Ho^{165}, Lu^{175}, and Ta^{181}, it was possible to obtain sufficient experimental data to make a fairly complete comparison with the predictions of the simple rotational model of Bohr and Mottelson. Within the large experimental uncertainties the data were consistent with the theory. First rotational state transitions have been studied in Gd^{155}, Gd^{157}, Re^{185}, Ir^{191}, and Ir^{193}. In addition transitions of 73 and 83 kev were observed in Ir^{191} and Ir^{193}, respectively. The data are consistent with the assignment of the transitions as coming from levels of these energies. (auth)

6052

INTERPRETATION OF REGULARITIES IN NEUTRON AND PROTON SEPARATION ENERGIES. A. de-Shalit (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev. 105, 1528-30 (1957) March 1.

Way's empirical rule on the behavior of separation energies of nucleons is analyzed. It is shown that this rule could be expected from general properties of the shell model, and the sort of information which can be obtained from its detailed analysis is discussed. (auth)

6053

M1 TRANSITION IN Tl^{208}. A. de-Shalit (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev. 105, 1531-3(1957) March 1.

An attempt is made to explain the abnormally short lifetime of the 40-kev level in Tl^{208}. It is shown that although by assuming a certain configuration it is possible to arrive at a coherent contribution to the transition probability from the proton orbital momentum, its magnetic moment, and the neutron magnetic moment, this is not enough to explain the observed lifetime. Configuration interaction can be estimated fairly accurately in this case, and it, too, does not improve the agreement. (auth)

6054

HALF-LIVES OF Sc^{46}, Co^{60}, Zn^{65}, Ag^{110m}, Cs^{134}, AND $Eu^{152,154}$. K. W. Geiger (National Research Council, Ottawa, Can.). Phys. Rev. 105, 1539-40(1957) March 1.

The half lives of six gamma-emitting nuclides were determined by comparison with radium standards, using a lead-shielded ionization chamber. The following results were obtained: Sc^{46}: 83.89 ± 0.12 days; Co^{60}: 5.24 ± 0.03 years; Zn^{65}: 243.5 ± 0.8 days; Ag^{110m}: 252.5 ± 1.5 days; Cs^{134}: 2.07 ± 0.02 years; $Eu^{152,154}$: 12.2 ± 0.2 years. The errors quoted are twice the standard deviation calculated from a least-squares analysis. (auth)

6055

PAIRING EFFECT IN NUCLEI. Y. F. Bow (National Taiwan Univ., China and Michigan State Univ., East Lansing). Phys. Rev. 105, 1541-4(1957) March 1.

It has been previously pointed out by Suess and Kowarski that near the closed neutron shells N = 50 and N = 82 the pairing energy of protons is greater than that of neutrons. Glueckauf found the same situation existing in heavy nuclides. Kohman has suggested that this effect may be fairly general in the region of medium-weight and heavy nuclides; however, several regions in which the effect is in the opposite direction have also been reported. On the basis of a generalized atomic mass equation for odd-A nuclides, the function ϵ defined by Kohman as the difference between proton pairing energy π and neutron pairing energy ν was calculated. It turns out that Kohman's suggestion seems to be in the right direction but with a restricted sense. A theoretical explanation consistent with the assumptions proposed by Mayer for the j−j coupling single-particle model has been investigated. The effect on this explanation of the absence of odd-proton isomerism for $63 < Z < 82$ has also been discussed. (auth)

6056

SHELL MODEL FOR THE POSITIVE-PARITY STATES OF N^{15}. E. C. Halbert and J. B. French (Univ. of Rochester, N. Y.). Phys. Rev. 105, 1563-9(1957) March 1.

Energy levels and wave functions arising from the configurations $s^4p^{10}s$, $s^4p^{10}d$, and s^3p^{12} have been calculated using a central plus single-particle spin-orbit interaction. Correlations have been made between theory and experiment for a dozen identified positive parity levels in N^{15} (in-

cluding the 5.31-Mev level). For the seven levels below 9 Mev this has been done mainly by considering $N^{14}(d,p)$ l values and reduced widths. In order of increasing energy, the theoretical spin assignments for these levels are $5/2$, $1/2$, $7/2$, $3/2$, $5/2$, $1/2$, $3/2$ (the third and fifth could be interchanged); the wave functions derived for these levels give fair agreement for level positions and surprisingly good agreement for reduced widths. For the upper levels, correlations are made by means of the experimental spin assignments. The general agreement here is poor; in particular, a state which has been invoked to explain thermal neutron capture and other neutron processes is not predicted, and the C^{15} β-decay lifetime is not properly given. In general, the wave functions indicate a small interaction between configurations but, apart from this, are not consistent with the idea that the inequivalent particle is effectively coupled to only one state for A = 14. (auth)

6057

ALPHA-PARTICLE BOMBARDMENT OF MAGNESIUM ISOTOPES. H. G. Graetzer and A. B. Robbins (Yale Univ., New Haven, Conn.). Phys. Rev. 105, 1570-2(1957) March 1.

Energy levels in three aluminum isotopes have been observed with alpha-particle bombardment of magnesium isotope targets. Protons from the reaction were observed with a proportional counter. By using an aluminum foil changer before the counter and recording only those protons near the end of their range, an energy resolution from 4 to 8% was obtained in the various runs. The ground-state Q values were calculated by comparison to the $Mg^{24}(\alpha,p)Al^{27}$ ground-state group using the known Q value for the inverse reaction. The ground-state Q values were found to be -1.29 ± 0.04 Mev for $Mg^{25}(\alpha,p)Al^{28}$, and -2.90 ± 0.04 Mev for $Mg^{26}(\alpha,p)Al^{29}$ Proton groups were found corresponding to excited states in Al^{27} at 0.85, 1.06, 2.17, and 2.64 Mev; in Al^{28} at 1.00, 1.57, 2.18, 2.54, and 2.96 Mev; in Al^{29} at 1.69 Mev. The mass value of Al^{29} was calculated to be 28.98972 ± 0.00006 amu. (auth)

6058

NUCLEAR SIZE FROM COSMIC-RAY INTERACTIONS. M. S. Sinha and N. C. Das (Bose Inst., Calcutta, India). Phys. Rev. 105, 1587-90(1957) March 1.

The total path length of 3625 penetrating charged secondaries of average energy 4 Bev has been measured in three plate assemblies of Al, Cu, and Pb inside a big square cloud chamber. The total number of nuclear interactions observed were divided into two groups, (i) nuclear disintegrations (high-energy transfers) and (ii) nuclear scatterings (elastic), and the total cross section and the cross section for nuclear disintegrations alone have been determined. It has been found that the equivalent square-well radii of Al, Cu, and Pb found from the latter cross sections agree well with $1.19A^{1/3} \times 10^{-13}$ cm whereas the radii corresponding to the total cross sections follow $1.34A^{1/3} \times 10^{-13}$ cm. The results thus indicate the same matter distribution in Al, Cu, and Pb nuclei as that determined from high-energy electron scattering, mu-mesonic x-ray data, and high-energy neutron absorption data. Moreover, each nucleus appears to be surrounded by an equivalent spherical shell of thickness $0.15A^{1/3} \times 10^{-13}$ cm which chiefly accounts for the elastic nuclear scatterings. The existence of this shell is presumably the effect of the finite range of nuclear forces. (auth)

6059

PRECISION METHOD FOR OBTAINING ABSOLUTE VALUES OF ATOMIC BINDING ENERGIES. Carl Nordling, Evelyn Sokolowski, and Kai Siegbahn (Univ. of Uppsala, Sweden). Phys. Rev. 105, 1676-7(1957) March 1.

A precision method was developed for investigating atomic binding energies. It is based on the magnetic analysis of electrons from a substance exposed to x radiation. Brief descriptions are given of the equipment used, and data are included on the photoelectrons expelled from Cu. (B.J.H.)

6060

SPLITTING OF $^3S_1$ AND $^1S_0$ STATES IN Li^6. Taro Tamura (Univ. of Copenhagen, Denmark). Phys. Rev. 105, 1808-9 (1957) Mar. 15.

The splitting of the $^3S_1$ and $^1S_0$ states of Li^6 is calculated by applying Feingold's procedure of configuration mixing to the wave function which was used in our former calculation of the binding energy of the same nucleus. It is found that the usually used tensor force is strong enough to explain the big value of this splitting. (auth)

6061

ODD-ODD ISOTOPE HAVING ZERO SPIN. J. C. Hubbs, W. A. Nierenberg, H. A. Shugart, and J. L. Worcester (Univ. of California, Berkeley). Phys. Rev. 105, 1928-9 (1957) Mar. 15.

The nuclear angular momenta of two neutron-deficient isotopes of Ga were determined by the atomic-beam magnetic-resonance method. The results give I = 0 for Ga^{66} and I = 3/2 for Ga^{67}. Results indicate that a spin of zero for Ga^{66} is highly probable. (B.J.H.)

6062

MAGNETIC MOMENT AND SPIN OF $_{40}Zr_{51}^{91}$. E. Brun, J. Oeser, and H. H. Staub (Univ. of Zurich, Switzerland). Phys. Rev. 105, 1929-30(1957) Mar. 15.

A nuclear induction signal of Zr^{91} was observed in a saturated solution of $(NH_4)_2ZrF_6$ in D_2O using a Bloch-type nuclear resonance spectrometer. The spin of the Zr^{91} was found to be 5/2 and its magnetic moment was found to be -1.30284 ± 0.00002 nm. (B.J.H.)

6063

$C^{13}(p,p)C^{13}$: EXPERIMENT AND ANALYSIS. D. Zipoy, G. Freier, and K. Famularo (Univ. of Minnesota, Minneapolis). Phys. Rev. 106, 93-8(1957) Apr. 1.

The differential cross sections for the $C^{13}(p,p)C^{13}$ elastic scattering interactions were measured over an energy range from 1.5 to 3.4 Mev (incident proton energy) at scattering angles of 45.0°, 54.4°, 74.1°, 90.0°, 106.4°, 127.8°, 148.9° in the center-of-mass system. Methane gas, enriched to 72.5% in C^{13}, was used as a target material. The absolute differential cross sections computed through this experiment were accurate to about 6% in the nonresonant energy regions. The measured nonresonant cross sections at about 2 Mev were essentially equal to those for Coulomb scattering at $\theta = 45°$ and increased to about seven times Coulomb cross section at $\theta = 148.9°$. There was also an increase in measured cross section relative to the Rutherford cross section at all scattering angles as the proton energy was increased. Maxima in the cross sections were observed at incident proton energies of 2.00, 2.12, 2.33, 2.90, and 3.12 Mev. A phase-shift analysis of the resonances at 2.00, 2.12, and 2.33 Mev yielded assignments for J and π of 1^-, 3^-, and 1^+, respectively, and reduced widths relative to single-particle reduced widths of 0.10, 0.11, and 0.005, respectively. (auth)

6064

CAPTURE OF PROTONS IN K^{39}. J. de Veiga Simão and J. P. F. Sellschop (Cavendish Lab., Cambridge, Eng.). Phys. Rev. 106, 98-9(1957) Apr. 1.

Evaporated natural potassium metal targets were bombarded with protons from a Cockcroft-Walton generator. The excitation function was studied from 0.5 to 1.15 Mev. The gamma rays from a level found in calcium 40 at 9.29 Mev above the ground state were studied with single-crystal spectrometers and with a pair spectrometer. Gamma rays of energy 9.29 ± 0.005 Mev, 5.93 ± 0.005 Mev,

5.55 ± 0.005 Mev, 3.73 ± 0.005 Mev, and 0.500 ± 0.005 Mev were found and suggest a decay scheme in agreement with the levels in Ca^{46} found by Braams by inelastic proton scattering. (auth)

6065

NEUTRON RESONANCES IN THE KEV REGION: ODD-INTERMEDIATE NUCLEI. Harvey Marshak and Henry W. Newson (Duke Univ., Durham, N. C.). Phys. Rev. 106, 110-16(1957) Apr. 1.

The total neutron cross sections of Sc^{45}, V^{51}, Mn^{55}, Co^{59}, Cu^{63}, and Cu^{65} have been measured in the energy range of ~1 to ~100 kev. The resonance parameters, including tentative J-value assignments, have been obtained for some of the more pronounced resonances observed. In the low-energy region, where measurements overlap with those made with time-of-flight equipment, the results for the 2.36-kev resonance in Mn^{56} and the 4.1-kev resonance in Sc^{46} are in good agreement. $\bar{\Gamma}_n^0/\bar{D}$ (averaged between 1 and 100 kev) was determined for Cl, K, Ni^{58}, Ni^{60}, As^{75}, and the above six nuclei. To calculate $\bar{\Gamma}_n^0/\bar{D}$ the average experimental transmission data were compared to the average Breit-Wigner transmission. The variation of $\bar{\Gamma}_n^0/\bar{D}$ with atomic weight has been compared to the theoretical predictions of the Feshbach, Porter, and Weisskopf model of the nucleus. The results indicated that the peak is around A = 47, and the amplitude is about 5×10^{-4}. These values would roughly correspond to a real potential, $V_0 = 46.5$ Mev, and $\zeta = 0.05$ for the complex fraction of the potential; a square potential well and a radius $R = 1.45A^{1/3} \times 10^{-13}$ were assumed. (auth)

6066

NUCLEAR SPIN RELAXATION IN HYDROGEN. 1. THE GAS. Myer Bloom. Physica 23, 237-47(1957) Mar.

The proton spin-lattice relaxation time t_1 has been measured in H_2 gas as a function of (a) density at 20.4°K, (b) ortho-para concentration at 20.4°K, (c) percentage H_2 molecules in H_2–He mixtures at 20.4°K, (d) density of the saturated vapor between 20.4°K and 15.5°K. The results are interpreted in terms of the relaxation mechanism originally proposed by Schwinger and provide a measurement of the cross section for collisions which cause the ortho-H_2 molecules to reorient. The average cross section for collisions which produce reorientations is three times as high for ortho-ortho collisions as for ortho-para collisions at 20.4°K. The effective cross section rises rapidly with decreasing temperature. It is suggested that t_1 measurements will enable a detailed study of the anisotropic part of the H_2–H_2 and H_2–He interactions to be made. The proton t_1 in HD is much longer than that of the protons in H_2 because the ground state of HD is J = 0 where the Schwinger mechanism is inoperative. One can infer the mean time spent by HD molecules in the J = 1 state from t_1 measurements. (auth)

6067

ELECTRICAL OCTUPOLE COULOMB EXCITATION IN RHODIUM. G. A. Jones and W. R. Phillips (Univ. of Cambridge, Eng.). Proc. Roy. Soc. (London) A239, 487-93 (1957) Apr.

The electric octupole excitation of the 40 kev isomeric state in Rh^{103} has been observed with protons of energies 700 to 1200 kev. The energy dependence of the cross section is consistent with that predicted by the W. K. B. treatment of Alder and Winther. The absolute cross section is about three times that expected theoretically. Possible explanations for this discrepancy are suggested. (auth)

NUCLEAR REACTORS

6068 AECU-3398

American Radiator and Standard Sanitary Corp. Atomic Energy Div., Redwood City, Calif.

COMPARISON OF CALDER HALL AND PWR REACTOR TYPES. A. Puishes, D. P. Herron, D. R. Mash, and J. W. Webster. Mar. 1, 1957. 80p. Project Size-up. Contract AT-(04-3)-109. $0.60(OTS).

A comparison from the economic and technical standpoints is made of the British Calder Hall design and the U. S. Shippingport PWR design. The basis of comparison is an advanced design which could be placed in operation in the early 1960's. When built in the U. S., it is concluded that power costs from the two reactors are almost the same. In Britain, however, the Calder Hall type reactor would have a decided economic advantage. Cost estimates were also made for constructing these two reactors in Japan. Potentials for cost reduction are also discussed. Discussions of construction costs and power plant economics in the U. S., Great Britain, and Japan, the economic evaluation of power reactor designs, and the physics of the gas-cooled reactor are included in appendices. (B.J.H.)

6069 AERE-RP/M-40

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE TEMPERATURE COEFFICIENT OF REACTIVITY DUE TO THERMAL EXPANSION OF A REFLECTED SPHERICAL CORE. J. Codd. Apr. 1954. 15p.

An approximate expression is derived for the temperature coefficient of reactivity due to thermal expansion of a spherical core which is surrounded by a reflector. It is predicted that the temperature coefficient should be negative and smaller than the value for a bare spherical core composed of the same material. As an illustration the temperature coefficient is evaluated for a hypothetical reactor in which the reflector is non-capturing and the mean free paths in the core and reflector are equal. One group diffusion theory is used, and it is assumed that the core and reflector each consist of a single homogeneous medium. The effect of a variation in the nuclear cross-sections with temperature is not considered. (auth)

6070 AI-Memo-1684

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ADDITIONAL ANALYSIS OF SRE SAFETY. W. T. Morgan. July 1956. 10p. $1.80(ph OTS); $1.80(mf OTS).

Steam power demand changes in the SRE plant were analyzed to establish their effects on reactor control. Thermal transients from this source are believed to be small enough that they will be controlled by the heat capacity of the Na coolant. (D.E.B.)

6071 ANL-5687

Argonne National Lab., Lemont, Ill.

A TWO-GROUP ITERATION METHOD FOR ANNULAR CYLINDERS. B. I. Spinrad and C. N. Kelber. Mar. 1957. 12p. Contract W-31-109-eng-38. $0.15(OTS).

A procedure is outlined for obtaining the fluxes and currents in the two-group approximations in an infinite annular cylinder, together with an estimate of k_∞ by a process of iteration. Corresponding to each initial estimate of the slow flux there is an iterative procedure to obtain an estimate of the fast flux, a new estimate of the slow flux, and an estimate of k_∞. The new estimate of the slow flux, in turn, can be used to repeat the process and thus to secure better estimates of k_∞ and the fluxes. There appears to be little difficulty in extending the procedure formally to more groups than two. (auth)

6072 ANL-5704

Argonne National Lab., Lemont, Ill.

ENGINEERING, CONSTRUCTION AND COST OF THE ARGONAUT REACTOR. R. H. Armstrong, W. L. Kolb, and D. H. Lennox. Mar. 1957. 43p. Contract W-31-109-eng-38. $0.50(OTS).

A general description of the Argonaut is given. Complete descriptive drawings of the reactor are included. A cost summation for the reactor is also given in tabular form. (B.J.H.)

6073 CF-56-2-128
Oak Ridge National Lab., Tenn.
EFFECTS OF HEAT GENERATION AND HEAT REMOVAL ON HRT SHUTDOWN AND DUMP. M. W. Rosenthal and H. C. Claiborne. Feb. 8, 1956. 55p. Contract [W-7405-eng-26]. $0.40(OTS).

The results indicate that, unless relieved, the HRT core pressure following shutdown quickly rises to a level which would endanger the core tank. After operation at 5 Mw, liquid discharge through the present let-down system would suffice to relieve the pressure, but it might not be sufficient at 10 Mw. Expulsion of vapor through the pressurizer vent line will also serve if it has sufficient capacity and the D_2-O_2 explosion hazard is eliminated. The pressure differences which will occur between core and blanket might be excessive if the systems are dumped from 2,000 psia. Relief of overpressure by controlled venting of vapor before the dump is initiated would mitigate the situation. Heat transfer by condensation can aggravate the dump problem; blowing-down of the heat exchangers before a dump might be desirable. (auth)

6074 CF-56-6-175
Oak Ridge National Lab., Tenn.
THE H.R.R. THIMBLE DESIGN PROBLEM. R. F. Hughes. June 27, 1956. 15p. Contract [W-7405-eng-26]. $3.30 (ph OTS); $2.40(mf OTS).

The thimble design selected for the H.R.R. is described. The effect of tube size, tube thickness, and coolant temperature on stress is discussed. (T.R.H.)

6075 CF-56-8-207(Del.)
Oak Ridge School of Reactor Technology, Tenn.
GAS COOLED, NATURAL URANIUM, D_2O MODERATED POWER REACTOR; REACTOR DESIGN AND FEASIBILITY PROBLEM. R. C. Dahlberg, E. G. Beasley, T. K. DeBoer, T. C. Evans, D. F. Molino, W. S. Rothwell, and W. R. Slivka. Aug. 1956. Decl. with deletions Feb. 8, 1957. 150p. $0.75(OTS).

The attractiveness of a helium-cooled, heavy water moderated, natural uranium central station power plant has been investigated. A fuel element has been devised which allows the D_2O to be kept at a low pressure while the exit gas temperature is high. A preliminary cost analysis indicates that, using currently available materials, competitive nuclear power in foreign countries is possible. (auth)

6076 CF-57-3-120
Oak Ridge National Lab., Tenn.
SOURCE OF FISSION PRODUCTS IN LITR COOLING WATER. Dade W. Moeller and G. W. Leddicotte. Mar. 26, 1957. 6p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The presence of fission products in LITR coolant was traced to contaminant U on the surface of fuel plate Al cladding. The contamination was assumed to occur during fuel plate fabrication. (D.E.B.)

6077 CISE-53
Centro Informazioni Studi Esperienze, Milan.
CRITERA OF A PROJECT FOR A 10-MW NATURAL URANIUM, HEAVY WATER REACTOR: CHARACTERISTICS AND DIMENSIONS. (Criteri di Progetto per un Reattore da 10 MW a Uranio Naturale e Acqua Pesante: Caratteristiche e Dimensionamento). A. Ascari, U. L. Businaro, G. Franco, S. Gallone, and C. Salvetti. Feb. 8, 1957. 26p.

6078 CRNE-512
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
THE DECAY OF NEUTRON FLUX IN THE NRX PILE FOR TWENTY-FOUR HOURS AFTER SHUT-DOWN. P. R. Tunnicliffe. Aug. 1952. 10p. (RDP-48; AECL-401).

Observations of the decay of neutron flux in the thermal column of the NRX reactor after shut-down have been compared with data given by Johns and Sargent (CRP-416) for ZEEP. Some adjustments of their data have been made to give a better fit to the observations. (auth)

6079 CRRP-685
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
A UNIVERSAL CURVE FOR THE PREDICTION OF XENON POISON AFTER A REACTOR SHUTDOWN. A. G. Ward. Jan. 25, 1957. 9p. (AECL-411).

6080 E.443/N-13
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
FLUXES AND CURRENTS IN E.443. J. D. McCullen. Jan. 20, 1954. Decl. Dec. 6, 1956. 3p.

Graphs are attached giving the radial and axial fluxes in the core and reflectors. These are based on a two group method of calculation. The fast and thermal currents at the interfaces and boundaries are shown at the appropriate positions. The radial fluxes relate to a plane through the core center and perpendicular to the axis. The axial fluxes relate to a plane through the core containing the axis. The calculations pertain to a core containing 130 C_ϕ material and with a diffusion length $L_\phi = 8.66$ cms. (auth)

6081 FSG-7
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
LIQUID FUEL ELEMENTS. S. G. Bauer. Sept. 1, 1953. 5p.

The problems and possibilities of using liquid or pseudo-liquid fuel elements are briefly discussed. An illustration of a particular liquid fuel element is discussed in an appendix. (B.J.H.)

6082 FSG-22
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
HOMOGENEOUS THERMAL REACTORS. R. Hurst, F. W. Fenning, J. Smith, and J. E. B. Perkins. June 2, 1954. Decl. Dec. 6, 1956. 10p.

In order to narrow the field in which investigations should be carried out in more detail, a general examination is made of the nuclear possibilities of the various hydrogen and deuterium moderated systems, appraisal of the chemical and engineering possibilities being limited to aqueous systems. It is concluded that for power reactors, the most promising systems are either a core system with fissile material in solution and fertile material in the form of a slurry, or a highly enriched solution-type core with a slurry blanket. Heavy water is essential for good neutron economy. The use of H_2SO_4, NaOH or fused salts, although offering some design advantages for high-temperature operation, increases fissile material investment because of the low hydrogen density, and the competing absorption (e.g. in S or Na) is a drawback. Their use is therefore likely to be confined to possible mobile applications or where the fluidized fuel is separate from a further moderating substance. (auth)

6083 FSG-37
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THERMAL REACTOR PLUTONIUM–URANIUM FUEL CYCLES. J. V. Dunworth. July 14, 1954. Decl. Dec. 6, 1956. 3p.

6084 KAPL-1645
Knolls Atomic Power Lab., Schenectady, N. Y.
TORQUING OF BOLTS FOR NUCLEAR REACTORS. F. J. Mehringer. Aug. 22, 1956. 124p. Contract W-31-109-eng-52. $0.60(OTS).

As a result of the bolting problems of the S1G and S2G reactors, torque tests were made on several different types of bolts. The main investigation was concerned with Type 347 stainless steel bolts of four different sizes which had a modified unified national coarse thread. The nuts were also made of austenitic stainless steel but with standard threads. Measurements of the axial stress and effective uniaxial stress in the bolt were determined as a function of torque. The test results are presented graphically. Since the bolts were typical of those to be used in the reactor sodium systems, they were tested without any lubrication. Subsequent bolts tested were made of such materials as Type 416 stainless steel and SAE 4140 steel. In some tests the effect of lubrication was also investigated. Bolts of sizes up to $1\frac{1}{4}$ in. diam were tested. Most of these latter results are presented in tables. The nuts used in all tests were fabricated of an austenitic stainless steel. (auth)

6085 KAPL-M-CJR-3
Knolls Atomic Power Lab., Schenectady, N. Y.
NUCLEAR AND THERMAL DESIGN OF A HYPOTHETICAL REACTOR. Carol J. Ranney and Milton F. Pravda. Feb. 1, 1957. 113p. Contract [W-31-109-Eng-52]. $16.80(ph OTS); $5.70(mf OTS).

A step by step procedure is given for designing a reactor core using hand calculations and approximations. Both the reactor physics and thermal design aspects of the core are considered. (B.J.H.)

6086 NAA-SR-Memo-1633
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
SRE DESIGN CHANGES. J. E. Owens. May 4, 1956. 9p. $1.80(ph OTS); $1.80(mf OTS).

A study of the SRE operating characteristics, both nuclear and thermal, has led to several design changes. These changes will minimize the thermal transients the reactor components must withstand, simplify the operational procedures, increase the reliability of the control circuits, and enhance the over-all safety of the plant. These changes are discussed. (auth)

6087 NAA-SR-1700
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
ORGANIC MODERATED REACTOR EXPERIMENT PROGRESS REPORT NO. 1 [FOR] OCTOBER 1955–JULY 1956. C. A. Trilling, ed. Mar. 15, 1957. 190p. Contract AT(04-3)-88. $1.00(OTS).

A comprehensive review is given of technical progress on the Organic Moderated Reactor Experiment. General descriptions are included of the site and facilities, the reactor core components, the heat transfer system, instrumentation, and auxiliary systems and equipment. In order to determine the optimum lattice configuration, studies were made of the effect of lattice size on the critical mass. Results of calculations are given in graphical and tubular form. Detailed core calculations were made for the final reference core design, and detailed results are included. Heat transfer calculations for the reactor are also summarized. Discussions of reactor control and safety include topics such as the control rod programming system, the automatic flux and temperature control system, startup accident studies, control studies of the air-blast heat exchanger, loss of coolant flow studies, an analysis of reactor stability, and coolant loop stability studies. Data on radiation levels from the reactor are also summarized. A hazards analysis of the OMRE is reviewed. The research program is outlined. Heat transfer studies on organic compounds are summarized. A detailed description of the OMRE is included in an appendix. (B.J.H.)

6088 NAA-SR-1896
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
PRELIMINARY RESULTS ON THE KINETIC BEHAVIOR OF WATER BOILER REACTORS. D. L. Hetrick, J. W. Flora, E. L. Gardner, B. R. Moskowitz, D. R. Muller, M. E. Remley, and R. K. Stitt. Apr. 15, 1957. 20p. Contract AT-11-1-GEN-8. $0.20(OTS).

The response of KEWB to step inputs of reactivity was explored in 62 self-limiting excursions, covering the range up to 0.94% reactivity. Parameters affecting shutdown behavior were determined. It was concluded that radiolytic decomposition gas is approximately seven times as effective as thermal expansion in limiting a neutron burst in a water boiler reactor at atmospheric pressure, provided the burst is rapid enough that most gas bubbles remain in the solution until after peak power is attained, and provided the dynamic pressures achieved are not large enough to interfere with the effect of gas bubbles on the reactivity. (auth)

6089 NDA-14-107
Nuclear Development Associates, Inc., White Plains, N. Y.
PROGRESS REPORT ON THE STUDY OF LOW PROBABILITY, HIGH HAZARD, FAST REACTOR ACCIDENTS. R. Daane, R. Mela, and J. DeFelice. Nov. 11, 1955. 56p. $0.40(OTS).

The methods being used to analyze highly hazardous but highly unlikely nuclear accidents are described. The assumptions made require more examination and, therefore, the results are probably too pessimistic for the model selected by factors of ten or a hundred. Two accidents are described in detail; rapid assembly and slow meltdown. In the rapid assembly, the core is considered to compress with a radial velocity of 15 ft/sec. The resultant rate of reactivity increase is $1250/sec. As the reactivity builds up, the core temperature increases, fuel is vaporized and eventually pressures are built up in the reactor which force the blanket outward and enable the core to increase in size to the extent that the reactor is shut down. This involves the generation of about 5000 megacalories of energy (5 tons of TNT) and pressures of up to 5×10^5 atm. These numbers are based on several assumptions which require more examination, among which are the following. The blanket completely surrounds the reactor. In practice, there are sodium header regions between the reactor and the end blankets. Equilibrium thermodynamic relationships are valid. Heat is generated uniformly throughout the core. This is probably the only assumption which may not lead to a conservative result. The reactivity remains constant from the time it reaches its maximum value until shutoff. Actually, the reactivity builds up to some maximum value during the accident, and then decreases until shutoff. Following a sudden loss of sodium coolant a slow meltdown of the core occurs in which molten uranium, steel, and perhaps zirconium come to rest, at least temporarily, on the graphite thermal shield beneath the reactor. If the melt then forms a critical mass, large amounts of energy could be released. If it

does not become critical, the melt can still overheat the containment vessel and release fission products to the environment or it could spread over a wide area of the graphite and cool harmlessly. More study is required to determine if all of these possibilities could occur. Two further accidents are considered; hydrogen insertion and autocatalysis. The first is shown to be less serious than the rapid assembly, while an answer to the second is obtained directly from the results of the rapid assembly. The design used in these calculations has changed since these calculations were made. The changes as of this date, however, will not appreciably affect the over-all results, because of the large uncertainty due to the assumptions made in the analysis. (auth)

6090 NRDC-22

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DEPENDENCE OF THE RATIO $Pu^{240}-Pu^{239}$ ATOMS IN A NATURAL URANIUM REACTOR ON THE CAPTURE CROSS-SECTION OF Np^{239} AND THE THERMAL NEUTRON FLUX. J. F. Hill. Mar. 10, 1953. 6p.

For a natural U reactor the increase in the ratio Pu^{240}/Pu^{239} atoms over its value when the Np^{239} capture cross section is assumed negligibly small is found as a function of the assumed Np^{239} cross section and the thermal flux. Assuming a capture cross section of 7000 b and a thermal neutron dose of 10^{20} neutrons per cm^2, this ratio is increased by about 12%, a factor of 2 and a factor of 10 respectively in a thermal flux of 10^{12}, 10^{13} and 10^{14} neutrons/cm^2/sec. It is also shown that, after the Np^{240} has come into equilibrium, this increase is almost exactly proportional to the thermal flux and to the Np^{239} cross section up to irradiations of about 600 Mwd/T. (auth)

6091 ORNL-1858

Oak Ridge National Lab., Tenn.

LOW-POWER CRITICALITY EXPERIMENTS ON THE HOMOGENEOUS REACTOR EXPERIMENT (HRE-1). Work period covered: January 1952 through May 1952. Sidney Visner and Philip M. Wood. Apr. 3, 1957. 97p. Contract W-7405-eng-26. $0.60(OTS).

The low power criticality behavior of the HRE has been experimentally investigated and in general, the theoretical predictions were confirmed. The HRE, which is fueled with an aqueous solution of highly enriched UO_2SO_4 in an 18-inch diameter spherical core and reflected by D_2O, was the first prototype of a circulating aqueous homogeneous power reactor and was intended to demonstrate stable operation at high power densities. Criticality was here achieved for the first time in a reactor through which a fluid fuel circulated with the attendant loss of delayed neutrons in the external circuit. It was demonstrated that except for the loss and recovery of reactivity on starting and stopping the circulating pump, the low power behavior of the HRE was qualitatively no different than in a static homogeneous system. In the main, the criticality data and the various reactivity coefficients agreed well with predictions based on two-group diffusion theory. At room temperature the critical concentration was 24.8 gm U^{235}/Kg H_2O, and the value of the reflector was 6.5% k_{eff}, which supports a calculated extrapolation distance of 4 cm on the unreflected core radius. The temperature coefficient of reactivity at room temperature was minus 0.37×10^{-3} k_{eff} per °C while at 220°C the value was minus 1.15×10^{-3} k_{eff} per °C. The temperature coefficient for the reflector was only minus 2.5×10^{-5} k_{eff} per °C. The pressure coefficient of reactivity for the core was 0.18% k_{eff} per thousand psi. The effectiveness of the control, shim, and safety rods together in Δk_{eff} was 1.3% at room temperature and 1.6% at 200°C. The decrease in the effective delayed neutron fraction on circulation was 0.20% k_{eff} as indicated by direct measurement of the change in reactivity and as also indicated by the inhour relationship. (auth)

6092 TID-7524

Oak Ridge Operations Office. Research and Development Div., AEC.

HRP CIVILIAN POWER REACTOR CONFERENCE HELD AT OAK RIDGE, MARCH 21-22, 1956. Mar. 1951. 261p. $0.50(OTS).

Eighteen papers from the homogeneous power reactor conference are included. Both one- and two-region reactors are considered from the standpoints of economy, design simplicity, fuel processing, and mechanical and metallurgical feasibility. Special attention is given to corrosion problems associated with the use of high-temperature solutions and slurries. The HRT, TBR, and LAPRE designs are discussed. (D.E.B.)

6093 TID-8014

Technical Information Service, AEC.

THE CHALLENGE TO INDUSTRY. Hyman G. Rickover, Naval Reactors Branch, Div. of Reactor Development, AEC. [nd]. 16p. $0.15(OTS).

One of Its monograph series "The Industrial Atom."

6094 WAPD-139

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

RESONANCE CAPTURE IN HETEROGENEOUS SYSTEMS. Stanley Stein. Nov. 1955. 33p. Contract AT-11-1-GEN-14. $0.30(OTS).

A model is described for the calculation of resonance escape probabilities in a variety of water moderated reactor lattices. The scheme was intended to help map a survey by Monte Carlo methods, and to provide a model for interpolation on the Monte Carlo results. A simple analytic calculation of p is possible from a knowledge of the resonance parameters and gives results in agreement with the Monte Carlo, over a wide range of parameters. The resultant resonance integrals for the known resonances in U^{238} are, however, significantly lower than measured experimentally, indicating the presence of additional absorption above 450 ev. The theory can be brought into agreement with the measurements if it is assumed that approximately 5.5 b of the effective absorption is due to unresolved resonances above 450 ev. (auth)

6095 YAEC-19

Yankee Atomic Electric Co., Boston.

MONTHLY PROGRESS REPORT FOR FEBRUARY 1957. Mar. 25, 1957. 18p. Contract AT(30-3)-222. $3.30(ph OTS); $2.40(mf OTS).

Work was continued on core design, performance calculations, preliminary laboratory tests, conceptual studies of some of the reactor systems and on the preparation of the Preliminary Hazards Summary Report. An irradiation program is being detailed and preparations are being made to perform the critical experiment. (For preceding period see YAEC-17.) (B.J.H.)

6096

FUEL CYCLES IN SINGLE-REGION THERMAL REACTORS. PART 2. Manson Benedict and Thomas H. Pigford (Massachusetts Inst. of Tech., Cambridge). Chem. Eng. Progr. 53, 145M-51M(1957) Mar.

The discussion of the limiting factors in fuel utilization in single-region thermal reactors is continued with the consideration of mixed-fuel reactors. Flowsheets for U–Pu fuel cycles and fuel costs are briefly discussed. The study is concluded with the treatment of single-region thermal breeders. (T. R. H.)

6097

HEAVY ISOTOPE BUILDUP IN THE CORE OF A U^{233} BREEDER. R. W. Stoughton and J. Halperin (Oak Ridge National Lab., Tenn.). J. Nuclear Energy 4, 279-92(1957) Mar.

The buildup of U isotopes with time in a U^{233} breeder core was calculated for five different cases, the difference depending on the starting fuel and the isotopic composition of the continuously added make-up fuel. The total U concentration was found to approach slowly an equilibrium value of 2.6 to 3.5 times the starting value, depending on the composition of the make-up fuel. In all cases the net neutron losses per net neutron reproduced in the core go through a maximum of less than 1% at a flux time of about 3×10^{21}, go through a minimum of about −0.6% (i.e. a net gain) at about a flux time of 4×10^{22}, and approach equilibrium values of about 0.3% at flux times above 6×10^{23}. (auth)

6098

HEAT TRANSFER AND ECONOMIC CONSIDERATIONS FOR SELECTING CORE SIZES AND CONFIGURATIONS. R. E. Behmer and B. L. Hoffman (Martin Co., Baltimore, Md.). Nuclear Sci. and Eng. 2, 14-23(1957) Feb.

An analytical procedure is presented for evaluating and correlating various heat transfer and economic parameters in order to optimize core size and configuration in the design of heterogeneous reactors. Maximum wall temperature calculations are used to determine a large range of reactor operating conditions with core size and shape as parameters. Information gained from crossplotting such information may then be used to estimate the sensitivity of the cost of the reactor system to some operating variable such as coolant flow rate, again with core size as a parameter. This information, coupled with fuel cost data as determined from nuclear calculations, can then be used to select an optimum core size and optimum operating conditions for a given system. (auth)

6099

TRANSIENT CONDUCTION IN NUCLEAR REACTOR FUEL ELEMENTS. Lloyd G. Alexander (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 2, 73-86(1957) Feb.

The problem of transient conduction in an unclad fuel plate with negligible surface resistance was solved analytically for the case wherein simultaneous step changes are made in the volume distributed heat generation rate and the surface temperatures. The solutions for the central (maximum) fuel temperature and the space-mean temperature are presented in graphs. A solution for the case of an arbitrary number of successive step changes was obtained by superposition (example), and an approximate solution for the case of arbitrarily and continuously varying heat release rate and surface temperatures coupled to the reactivity was discussed. (auth)

6100

A DIRECT MEASUREMENT OF THE URANIUM METAL TEMPERATURE COEFFICIENT OF REACTIVITY. R. M. Pearce and D. H. Walker (Atomic Energy of Canada Ltd., Chalk River, Ontario). Nuclear Sci. and Eng. 2, 24-32 (1957) Feb.

The U metal temperature coefficient of reactivity has been measured in ZEEP. A U sample was oscillated in the reactor and the resulting modulation of reactor power was measured as a function of the sample temperature. The temperature coefficient of uniformly heated U rods, 3.25 cm. in diameter, immersed in a constant temperature moderator (moderator-to-U volume ratio 22) is deduced from this experiment. Over the range +30°C to +230°C the coefficient is $dk/dT = -(1.25 \pm 0.09) \times 10^{-5}$ per °C. Over the range +10°C to −140°C the coefficient is $dk/dT = -(1.58 \pm 0.18) \times 10^{-5}$ per °C. (auth)

6101

EXPERIMENTAL STUDY OF TRANSIENT BEHAVIOR IN A SUBCOOLED, WATER-MODERATED REACTOR. F. Schroeder, S. G. Forbes, W. E. Nyer, F. L. Bentzen, and G. O. Bright (Phillips Petroleum Co., Idaho Falls, Idaho). Nuclear Sci. and Eng. 2, 96-115(1957) Feb.

As a part of a program of reactor safety investigations, the response of a heterogeneous, water-moderated and -reflected reactor (SPERT I) to instantaneous reactivity additions has been studied experimentally with initial temperature of 20°C and initial power level of 5 watts. Excess reactivity additions from approximately 0.3% to 1.4%, which result in asymptotic reactor periods from 10 sec to 7 msec, produced self-limiting power bursts with peaks up to 1300 Mw. Plots of the typical behavior of reactor power, fuel plate temperatures, and transient pressures for these tests are presented and discussed. Maximum reactor power, fuel plate temperature, pressure, energy release, and other quantities are correlated as functions of reactor period. The instantaneous excess reactivity of the system during the transient test has been computed from the experimental power behavior and typical results are shown. The reactivity compensation necessary to limit a power burst of this type has been determined and is discussed as a function of initial reactor period. Several mechanisms for the self-shutdown of the reactor are postulated and discussed in light of the experimental results. (auth)

6102

FAST BREEDER POWER REACTORS. THEIR PROBLEMS AND PROSPECTS. Nucleonics 15, No. 4, 62-6(1957) Apr.

The problems of fitting a fast breeder power reactor into a power reactor economy are described. The major drawbacks for this type of reactor are operation at high core-power density, problems of Na technology, high fuel costs because of large inventory and frequent reprocessing, and reactor safety. (W.L.H.)

6103

ENRICO FERMI REACTOR. DESIGN OF FIRST FAST BREEDER. Nucleonics 15, No. 4, 68-72(1957) Apr.

The design of the Enrico Fermi fast breeder power reactor is designed to generate 300 Mw of heat and deliver a net output of 90 Mw of electric power. It is fueled with 27%-enriched U and will breed Pu with a breeding ratio of 1.20. Heat is transferred from reactor to steam plant by primary and secondary Na coolant circuits. (W.L.H.)

6104

PRESSURIZED-WATER TEST LOOP AT MTR. Emil L. Martinec (Argonne National Lab., Lemont, Ill.). Nucleonics 15, No. 4, 73-7(1957) Apr.

The Argonne high-pressure water loop located in a tube mounted in the horizontal beam hole HB-2 of the MTR was built to circulate water at a pressure of 1,500 psi and at a temperature of 500°F. The maximum thermal neutron flux is 2.5×10^{14}. A brief functional description of the components of the loop and the operating equipment is included. (W.L.H.)

6105

GAMMA-RAY DOSE AND HEATING FROM SPENT MTR FUEL ELEMENTS. W. E. Francis and L. L. Marsden (Phillips Petroleum Co., Idaho Falls). Nucleonics 15, No. 4, 80-3(1957) Apr.

Spent MTR fuel assemblies are being used as high-intensity γ sources. Results are presented of a project to measure and calculate γ intensities and heating values as a function of fission time, cooling time, and distance from the source. Fuel elements with cooling times from $3\frac{3}{4}$ hr

to 218 days after reactor shutdown and fuel burnups of 3.5 to 35% were studied. (W.L.H.)

6106

AIR-DRYING SYSTEM FOR EBWR TURBINE SEALS. Edward L. Young (Allis-Chalmers Manufacturing Co., Milwaukee, Wis.). Nucleonics 15, No. 4, 105-6, 107(1957) Apr.

The system is located within the gastight enclosure that surrounds the entire EBWR and generating equipment. The air-drying and moisture-recovery system will prevent the loss of valuable moderator and the escape of radioactivity to the atmosphere. (W.L.H.)

6107

THERMONUCLEAR REACTIONS (SEARCH FOR CONTROLLED THERMONUCLEAR REACTION). L. A. Artsimovich and S. Yu. Luk'yanov. Priroda 46, No. 9, 18-25(1957) Jan. (In Russian)

A general review. (R.V.J.)

Refer also to abstract 5839.

NUCLEAR TRANSFORMATION

6108 ISC-726

Ames Lab., Ames, Iowa.

COMPARATIVE YIELDS OF $Fe^{54}(\gamma,pn)Mn^{52}$ AND $Fe^{54}(\gamma,2n)Fe^{52}$. Raymond M. Henry and Don S. Martin. Aug. 1955. 33p. Contract W-7405-eng-82. $0.25 (OTS).

The relative rates of formation of four photonuclear reactions produced by 70-Mev x-ray irradiations of iron metal were measured. The reactions investigated were the $Fe^{54}(\gamma,pn)Mn^{52m}$, $Fe^{54}(\gamma,pn)Mn^{52}$, $Fe^{54}(\gamma,2n)Fe^{52}$ and $Fe^{57}(\gamma,p)Mn^{56}$. The manganese yields were determined by measuring the radioactive manganese chemically separated from the target material. It was found that the total (γ,pn) yield was about 19 times greater than the $(\gamma,2n)$ yield. This result is explained in terms of the lower threshold energy of the (γ,pn) reaction, and the energy distribution of the gamma-ray spectrum. The ratio of the formation cross sections for Mn^{52} and Mn^{52m} indicated a higher probability for the formation of the metastable state by a factor of about two. The yields are compared to the $F^{19}(\gamma,n)F^{18}$ yield by irradiations of $FeSiF_6 \cdot 6H_2O$. Knowledge of the $F^{19}(\gamma,n)F^{18}$ to $N^{14}(\gamma,n)N^{13}$ ratios enable the other reaction yields to be compared to the nitrogen yield which, by convention, has been chosen as the standard reference. (auth)

6109

REACTION ENERGY OF $O^{18}(d,p)O^{19}$. Katarina Ahnlund. Arkiv Fysik 11, No. 4, 379-81(1957).

The 4.98-Mev deuteron beam from a Van de Graaff accelerator was used to bombard a Ni foil which was completely oxidized by enriched O. The spectrum of elastically scattered deuterons and the spectrum of protons from the $O^{18}(d,p)O^{19}$ reaction are shown. (B.J.H.)

6110

ANGULAR DISTRIBUTIONS OF PROTON GROUPS FROM THE REACTION $B^{10}(d,p)B^{11}$. Bo Sjögren (Nobel Inst. for Physics, Stockholm). Arkiv Fysik 11, No. 4, 383-90(1957).

Deuterons from a Cockcroft-Walton accelerator were used to bombard a target of natural elementary B with a thin foil backing. Typical spectra are shown for the three proton groups from the reaction $B^{10}(d,p)B^{11}$. (B.J.H.)

6111

ELECTRODISINTEGRATION OF Cu^{63} AND Mn^{55}. R. L. Hines (Univ. of Michigan, Ann Arbor). Phys. Rev. 105, 1534-9(1957) March 1.

The electrodisintegration of Cu^{63} and Mn^{55} has been investigated for total electron energies from 29.5 to 81.5 Mev by a stacked-foil experiment using the internal electron beam of a synchrotron. The value of $\bar{F}$, which is essentially the ratio of photon induced foil activity to electron induced foil activity, is found to be 8.32 ± 0.54 at 29.5 Mev, 5.47 ± 0.36 at 46.5 Mev, 5.31 ± 0.25 at 63.5 Mev, and 4.97 ± 0.05 at 81.5 Mev for the $Cu^{63}(e,e'n)Cu^{62}$ reaction. For the $Mn^{55}(e,e'3n)Mn^{52*}$ reaction, which has an effective excitation energy of 42 Mev, $\bar{F}$ is found to be 6.67 ± 0.41 at 63.5 Mev and 7.43 ± 0.40 at 81.5 Mev. Upon comparing these values with the theoretical values of $\bar{F}$ for different multipole photon absorption processes, it appears that the resonance peak in the nuclear photon absorption cross section for copper is due to a mixture of 97% of an electric dipole process and 3% of an electric quadrupole process. Nuclear size effects might make the experimental results compatible with a larger proportion of electric quadrupole process. Above the resonance peak, at energies near 42 Mev, the photon absorption appears to be due to either an electric dipole or a magnetic dipole process, but not an electric quadrupole process. (auth)

6112

DEUTERON-INDUCED REACTIONS LEADING TO N^{16}. Norman A. Bostrom, Emmett L. Hudspeth, and Ira L. Morgan (Univ. of Texas, Austin). Phys. Rev. 105, 1545-8 (1957) March 1.

The cross sections for the reactions $O^{18}(d,\alpha)N^{16}$ and $N^{15}(d,p)N^{16}$ have been determined and the excitation functions obtained for deuteron bombarding energies of 0.30 to 3.00 Mev. At a bombarding energy of 1.16 Mev, the $O^{18}(d,\alpha)N^{16}$ cross section is 44 mb, and the $N^{15}(d,p)N^{16}$ cross section is 280 mb. Resonances in the $O^{18}(d,\alpha)N^{16}$ excitation function occur at values which correspond to excited levels in F^{20} at 13.69, 13.91, 14.27, and 14.94 Mev. The rapidly rising smooth excitation curve for the reaction $N^{15}(d,p)N^{16}$ indicates a barrier penetration with some evidence for weak resonances corresponding to excited states in O^{17} at 15.18 Mev and 15.69 Mev. Attempts were made to detect the reaction $C^{14}(d,\gamma)N^{16}$; it was possible to set only an upper limit of 0.1 mb on the cross section for this reaction at a bombarding energy of 1.16 Mev. Scintillation spectrometry of the N^{16} decay shows the ratio of the intensities of the 6.133- and 7.10-Mev γ-rays to be 1:0.81. (auth)

6113

ANGULAR DISTRIBUTIONS OF PROTONS FROM THE ALPHA-PARTICLE BOMBARDMENT OF B^{10}, Al^{27}, AND P^{31}. P von Herrmann and G. F. Pieper (Yale Univ., New Haven, Conn.). Phys. Rev. 105, 1556-62(1957) March 1.

Angular distribution measurements have been carried out on the protons corresponding to the ground state transition in the $B^{10}(\alpha,p)C^{13}$ reaction at bombarding energies of 8.1, 7.0, and 4.9 Mev, on the protons corresponding to the ground state and first-excited state transitions in the $Al^{27}(\alpha,p)Si^{30}$ reaction at bombarding energies of 8.1 and 7.1 Mev, and on the protons corresponding to the ground state transition in the $P^{31}(\alpha,p)Si^{34}$ reaction at bombarding energies of 8.1 and 7.0 Mev. According to rather qualitative criteria concerning the changes in the shapes of the distributions with bombarding energy, the Al results appear to be interpretable in terms of a compound nucleus process, while the B and P results indicate the possibility of a contribution from a direct interaction process. Some discussion is given concerning the possibility of applying a direct interaction process like that of Austern, Butler, and McManus to such alpha-particle-induced reactions. (auth)

6114

NEUTRON PRODUCTION BY μ MESONS STOPPED IN SODIUM AND MAGNESIUM. D. R. Jones (Washington Univ., St. Louis, Mo.). Phys. Rev. 105, 1591-8(1957) March 1.

Measurements of the production of neutrons by negative μ

mesons which stop and interact in two materials, sodium and magnesium, are reported. The mean number of neutrons emitted per interaction was found to be 0.6 ± 0.2 for magnesium and 1.0 ± 0.4 for sodium, where the uncertainties include an estimated contribution from systematic sources as well as those of a statistical nature. The data confirm that neutron production in magnesium is less than in lead (multiplicity 1.7 ± 0.3), but show that it is not zero. Neutron production in sodium also is shown to be measurable and probably greater than in magnesium, though less than in lead. In the course of the experiment a value of $(1.18_{-0.14}^{+0.19})$ μsec (statistical) was found for the mean life of negative μ mesons in sodium. (auth)

6115

PRODUCTION OF PHOTOSTARS BY BREMSSTRAHLUNG OF 250 TO 500 Mev. Vincent Z. Peterson (California Inst. of Tech, Pasadena) and Charles E. Roos (Univ. of California, Riverside). Phys. Rev. 105, 1620-6(1957) March 1.

The yield of photostars in nuclear emulsion as a function of bremsstrahlung energy has been found to increase rapidly from 6.8 millibarns per Q (total beam energy/maximum beam energy) at 250 Mev to 22.8 millibarns per Q at 500 Mev, for stars of 2 or more prongs from silver nuclei. The cross section for silver was derived by averaging the emulsion nuclei (excluding H) in proportion to their atomic weights. The total photodissociation cross section is estimated to be at most 20% larger due to the addition of one-prong and zero-prong stars. The cross section per photon is derived by the photon difference method, and is found to be about 30 millibarns per silver nucleus above 300 Mev. This very large cross section is approximately 100 times the free nucleon total photomeson cross section. Therefore, photostar production from reabsorption of real pions produced in nuclear matter requires a very short mean free path ($\lambda \approx 1 \times 10^{13}$ cm). (auth)

6116

ANGULAR DISTRIBUTION AND CORRELATION STUDIES OF Be^9, Be^{10}, AND Mg^{24} (d,p) REACTIONS. S. A. Cox and R. M. Williamson (Duke Univ., Durham, N. C.). Phys. Rev. 105, 1799-1808(1957) Mar. 15.

(d,p) angular distributions have been measured along with (p,γ) correlations in Be^9, B^{10}, and Mg^{24} in order to test the applicability of stripping correlation theory and assign tentative quantum numbers. Deuteron energies were 2.5 to 4 Mev. All correlations exhibited the predicted deuteron energy independence and approximate angular symmetry in the (d,p) plane at energies above 3.5 Mev. The Be^9 correlation was shown to be isotropic to ±7% in the plane perpendicular to the axis of the recoil nucleus. The observation of a (d,p) stripping peak 2 or 3 times the minimum yield is not a sufficient criterion for the observation of a correlation which is independent of deuteron energy. All correlations were of the form $1 + A\cos^2\theta$ (gamma, recoil nucleus). The observed A's were −0.50, 0.00, +0.50, −0.40, for Be^{10*} (3.37 Mev), B^{11*} (4.46 Mev), B^{11*} (6.76 Mev), Mg^{25*} (3.40 Mev), respectively. All uncertainties in A's were ±0.05. Spin ½ is ruled out for Mg^{25*} (3.40 Mev). The Be^9 anisotropy is within 15% of one extreme of theoretically possible anisotropies. The incoming channel spin mixing ratio found in Be^9 can be gotten by assuming pure L-S coupling and a $^3P_2$ Be^{10*} level. The spin ⅝ is unlikely for the B^{11*} (4.46 Mev) level, while the spin ⅜ is ruled out and ⅝ is unlikely for the B^{11*} (6.76 Mev) level. (auth)

6117

ANALYSIS OF ANGULAR DISTRIBUTIONS IN THE $C^{13}(\alpha, n)O^{16}$ REACTION. J. P. Schiffer, Alfred A. Kraus, Jr., and J. R. Risser (Rice Inst., Houston, Texas). Phys. Rev. 105, 1811-15(1957) Mar. 15.

From the study of the angular distributions in the $C^{13}(\alpha, n)O^{16}$ reaction, angular momentum assignments have been obtained for thirteen states of the compound nucleus, O^{17}. Some relative parity assignments were made on the basis of interference effects. (auth)

6118

DIFFERENTIAL CROSS SECTION FOR THE $C^{13}(He^3,\alpha)C^{12}$ REACTION AT 2.00 Mev. H. D. Holmgren (U. S. Naval Research Lab., Washington). Phys. Rev. 106, 100-1(1957) Apr. 1.

The differential cross sections for the $C^{13}(He^3,\alpha)C^{12}$ reaction have been measured for ground state and first excited state α-particle groups at a bombarding energy of 2.00 Mev for sixteen center-of-mass angles extending from 5 to 152 degrees. These data have been fitted with Legendre polynomial expansions including polynomials up to the sixth degree by the method of least-squares. The coefficients in these expansions and the total cross sections are tabulated. (auth)

6119

$C^{13}(He^3,\alpha)C^{12}$ ANGULAR DISTRIBUTIONS AT 4.5 Mev. H. D. Holmgren, E. H. Geer, R. L. Johnston, and E. A. Wolicki (U. S. Naval Research Lab., Washington). Phys. Rev. 106, 102-4(1957) Apr. 1.

The angular distributions of the α-particle groups from the $C^{13}(He^3,\alpha)C^{12}$ reaction which leave the C^{12} nuclei in the ground and first excited states have been measured at a bombarding energy of 4.5 Mev. The angular distributions have been fitted with Legendre polynomial expansions. In order to fit the data within the experimental uncertainties it was necessary to include polynomials up to the eighth degree in these expansions. It appears unlikely that the angular distributions can be accounted for on the basis of compound-nucleus type of reaction. Although the usual concept of a pickup type reaction also encounters difficulties in attempting to account for this reaction, theoretical calculations based on this type of process have been compared with the experimental results. Other possible mechanisms by which this reaction may take place are suggested. (auth)

6120

$Al^{27}(n,\alpha)Na^{24}$ REACTION INDUCED BY 14.8-Mev NEUTRONS. I. Kumabe, E. Takekoshi, H. Ogata, Y. Tsuneoka, and S. Oki (Univ. of Kyoto, Japan). Phys. Rev. 106, 155-6 (1957) Apr. 1.

Samples of aluminum foil inserted between two C2 nuclear plates were bombarded with 14.8-Mev neutrons, and the angular and energy distributions of the alpha particles resulting from $Al^{27}(n,\alpha)Na^{24}$ reaction were measured. It was found that the angular distribution of all energy regions in the center-of-mass system is concave upward and approximately 90° symmetrical. Also the curve on a semilog plot of the relative level density calculated from the energy distribution of the alpha particles fits a straight line which would correspond exactly to Maxwellian distribution with a temperature of about 1.45 Mev. The results are compared with the predictions of the statistical theory. (auth)

6121

INVESTIGATION OF FOUR RESONANCES IN THE REACTION $^{26}Mg(p,\gamma)^{27}Al$. C. Van Der Leun, P. M. Endt, J. C. Kluyver, and L. E. Vrenken. Physica 22, 1223-33(1956) Dec.

The γ radiation produced in the reaction $Mg^{26}(p,\gamma)$ Al^{27} at four resonances (E_p = 339, 454, 661, and 723 kev) has been investigated with a NaI scintillation spectrometer. Pulse spectra taken at each resonance at angles of $\varphi = 0°$ and $\varphi = 90°$ to the proton beam were analyzed with a 70-channel Hutchinson-Scarrott kicksorter. More information as to the deexcitation of the resonance levels was obtained from γ−γ coincidence measurements. The following spins are

deduced from the experiments: 0.84 Mev: J = 1/2; 2.21 Mev: J = (3/2); 2.73 Mev: J = 5/2; 2.98 and/or 3.00 Mev: J = 3/2; 3.68 Mev: J = 1/2; 4.05 Mev; J = 1/2; 8.59 Mev: J = 3/2; 8.70 Mev: J = 1/2; 8.90 Mev: J = 1/2 and 8.96 Mev: J = 3/2. (auth)

6122

THE REACTION $^{32}S(p,\gamma)^{33}Cl$. C. van der Leun and P. M. Endt. Physica 22, 1234-6(1956) Dec.

The search for resonances in the $S^{32}(p,\gamma)Cl^{33}$ reaction was extended to E_p = 800 kev by bombarding a thin ZnS target with protons from a Cockcroft-Walton. Only one resonance, at 594 ± 5 kev, could be attributed to this reaction. Data are included on the γ radiation at this resonance. (B.J.H.)

6123

CHARACTERISTICS OF THE NUCLEAR DISINTEGRATION PRODUCED BY 140 ± 6 MEV PROTONS. II. HEAVY NUCLEI. S. Jannelli and F. Mezzanares. Nuovo cimento (10) 5, 380-92(1957) Feb. (In Italian)

The nuclear disintegrations produced in the heavy elements of Ilford G5 600 μm emulsions by 140-Mev protons have been studied. 634 stars were examined. The results of analysis are in agreement with the conclusions reached by other workers about the possibility of describing the production of stars according to the well known model of nuclear cascade followed by a nuclear evaporation. The existence of low energy protons emitted sometimes from the nuclei in the de-excitation process, following the evaporation, is confirmed. From the experimental data and those of other authors, the best values of some parameters which are relevant in the process of production of stars are produced. (auth)

6124

COMPARISON BETWEEN (n,p) AND (p,p') EXPERIMENTS ON INTERMEDIATE ENERGY. L. Colli and U. Facchini (Lab. CISE, Milano) and S. Micheletti. Nuovo cimento (10) 5, 502-9(1957) Feb.

An analysis of some experimental results giving proton spectra of n,p reactions induced with 14-Mev neutrons on ten elements ranging from Mg to Zr and the spectra of protons emitted in pp' reactions from eight elements from Al to Au under bombardment of 18-Mev protons has been made. It is evident that such results are not clearly interpreted in the statistical evaporation theory and that level densities of the residual nucleus cannot be derived. Furthermore a relation existing among these spectra is brought to evidence; this relation has been found valid in all comparable cases: the spectra of the protons emitted from n,p and pp' reactions are the same when the curves are compared versus the energy of the emitted proton. The shape of the spectra, when corrected for the effect of the barrier, does not show strong variations versus the mass number A of the nucleus. (auth)

6125

C AND Al PHOTOPROTON ANGULAR AND ENERGY DISTRIBUTION. C. Milone, R. Ricamo, and A. Rubbino. Nuovo cimento (10) 5, 528-31(1957) Feb.

Measurements were made of the energy spectra and angular distributions of photoprotons in C^{12} and Al^{27}. The experiment was performed by exposing Al and C targets to the 31-Mev bremsstrahlung beam from a betatron. (B.J.H.)

6126

PHOTOPROTONS FROM OXYGEN UP TO 30 MEV. C. Milone, R. Ricamo and R. Rinzivillo. Nuovo cimento (10) 5, 532-4(1957) Feb.

The photoproton yield for oxygen was measured up to 30 Mev by exposing Ilford C_2 plates to the beam from a betatron target. Experimental results are shown in graphical form. (B.J.H.)

PARTICLE ACCELERATORS

6127 AERE-G/M-126

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

PROTON ACCELERATION WITH ELECTRON BUNCHES. D. Luffman. Mar. 1952. 21p.

The type of accelerator considered is that in which protons are accelerated by the Coulomb forces from bunches of electrons, the bunches being constrained by the combination of a static longitudinal magnetic field and a travelling H_θ wave. The theory of electron injection and bunching is derived. A limitation on the maximum permissible proton current is discussed. A rough estimate of the r-f power flux and electric field strength is arrived at, but r-f power requirements and waveguide design are not considered. (auth)

6128 AERE-GP/M-146

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A METHOD OF SIMULTANEOUSLY FOCUSING AND ACCELERATING A BEAM OF PROTONS. J. H. Adlam. Jan. 1953. 27p.

A beam of protons is made to travel along the axis of an r-f accelerating structure. This structure is divided into sections within which the phase velocity of the r-f wave is constant, the phase of the r-f field being made continuous at the junction of two sections. The protons enter each section with a velocity less than the velocity of the r-f wave and leave it with a velocity greater than that of the r-f wave. While they are within the section, the phase position of a proton will vary. The accelerating field will therefore vary in magnitude and the radial field (tending to focus or defocus the beam) will vary in magnitude and sign. This variation in the phase position produces a net focusing force on a certain group of particles. This group of particles also holds together as it travels along the accelerator, which would not be the case for a normally designed accelerator. The tolerance upon the accelerating field in each section (among other quantities) is however much closer than for a normally designed accelerator. Calculations have been made for a particular case. (auth)

6129 AERE-GP/M-166

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A TRAVELLING WAVE MAGNETRON AMPLIFIER OPERATING IN THE CYCLOTRON MODE. P. D. Dunn. Nov. 1952. 45p.

A travelling wave linear magnetron amplifier operating in the cyclotron mode is considered. Calculations of efficiency for the structure suggested predict a value in the region of 30%. This value for efficiency may be further increased by obtaining Klystron-type interaction before collection. (auth)

6130 AERE-T/R-2077

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

TWIST RESONANCES. M. Bell. Oct. 1956. 34p.

A matrix form of the first order perturbation theory, for stationary values of Q_r and Q_v is given; this confirms the absence of a stop-band in the case of difference resonances, when $Q_r - Q_v$ = an integer, and predicts the width of the stop-band at sum resonances, when $Q_r + Q_v$ = an integer. A perturbation formula is given for the amplitude of the vertical oscillation set up by moving right through a resonance region. (auth)

6131 LA-2097

Los Alamos Scientific Lab., N. Mex.

EQUILIBRIUM ORBITS AND BETATRON OSCILLATONS

IN A SINUSOIDAL THOMAS ACCELERATOR. Fred L. Ribe. Nov. 1956. 18p. Contract W-7405-eng-36. $0.20 (OTS).

Analysis is made of a Thomas cyclotron having sinusoidal azimuthal magnetic field variation and a radial rate of increase (or decrease) of magnetic field specified by an arbitrary field index. The scalloped equilibrium orbits are found, and the frequencies of the betatron oscillations about these orbits are evaluated to second order in $1/N^2$, where N is the number of azimuthal "poles," or maxima of the magnetic field. (auth)

Refer also to abstract 6181.

RADIATION ABSORPTION AND SCATTERING

6132 CF-57-3-48

Oak Ridge National Lab., Tenn.

NEUTRON AND GAMMA-RAY ATTENUATION FOR A FISSION SOURCE IN WATER — COMPARISON OF THEORY WITH LTSF MEASUREMENTS. D. R. Otis. Mar. 12, 1957. 22p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70(mf OTS).

Calculations are presented of the fast neutron dose rate, the γ-ray dose rate, and the thermal neutron flux along the source plate axis in the Lid Tank with the tank filled entirely with water. These calculations are compared with experimental measurements. The calculations are absolute and are compared with absolute measurements. (auth)

6133

CONTRIBUTION TO THE STUDY OF THE RANGE-ENERGY CURVE FOR ELECTRONS FROM 23 TO 90 kev IN NUCLEAR EMULSION. J. Sacton. Bull. classe sci. Acad. roy. Belg. 42, 1118-22(1957) Nov. (In French)

The range-energy curve for 23-, 46-, 72-, and 90-kev electrons, obtained from an electron microscope, is studied in Ilford G5 nuclear emulsion. The method of measurement used is based on the determination of the real range of the electrons beginning with the projection and inclination of its track. The relative scatterings affecting the real and projected ranges are of the order of 15% at the 4 energies considered. The ratio of the real to the projected range is equal to 1.18 + 0.07. The results obtained are compared to those of the principal previous workers. (tr-auth)

6134

SCATTERING IN THE SOURCE AND ANGULAR CORRELATIONS. Jean Berthier. Compt. rend. 244, 1355-8(1957) Mar. 4. (In French)

A study is made of the importance of two effects produced on γ-γ angular correlations by so-called absorption or by scattering within the source itself. (tr-auth)

6135

ELASTIC SCATTERING OF γ QUANTA OF UP TO 120 MEV BY PROTONS. B. B. Govorkov et al (Lebedev Inst. of Physics). Doklady Akad. Nauk S.S.S.R. 111, 988-91 (1956) Dec. 11. (In Russian)

Studies were made of the angular distribution and of the absolute values of γp elastic scattering cross sections to determine the electromagnetic proton structure and the character of its interaction with the meson field. The experiments were carried out with γ quanta at energies not exceeding the threshold of π^- meson photoproduction, and the total cross sections obtained at such energies closely coincided with theoretical Thomson cross sections $\sigma_{Thom} = (8/3)\,\pi(e^2/Mc^2) = 1,\,93 \times 10^{-31}$ cm^2. The angular distribution of elastic scattering of up to 120-Mev γ quanta by protons was measured and results compared with Oxley and Telegdi (Phys. Rev. 100, 435(1955)). (R.V.J.)

6136

SCATTERING OF POSITIVE AND NEGATIVE π^- MESONS AT 300 MEV ON HYDROGEN. L. S. Dul'kova, I. B. Sokolova, and M. G. Shafranova (Lebedev Inst. of Physics). Doklady Akad. Nauk S.S.S.R. 111, 992-5(1956) Dec. 11. (In Russian)

Studies were made of 105 cases of elastic scattering of negative mesons and 149 cases of positive mesons in the angular interval from 10 to 170°. The thick layer photoplate method was used in the investigation. (R.V.J.)

6137

EXCITATION OF CHARACTERISTIC K X-RAYS BY THE IMPACT OF HEAVY CHARGED PARTICLES. Darko Jamnik and Črtomiur Zupančič. Kgl. Danske Videnskav. Selakab Mat. Fys. Medd. 31, No. 2, 1-15(1957).

The cross section for ejection of K electrons by slow ions is evaluated in the Born approximation for the incident particles, using relativistic electron wave functions. Numerical results are given for lead (and silver) and compared with experimental cross sections for excitation of characteristic K x rays. For silver, the relativistic corrections are small, but for lead they are appreciable and improve the agreement with experiment. Still, the theoretical cross sections for Pb as well as for Ag are not in quantitative agreement with the experimental values. The discrepancy is attributed mainly to a failure of the Born approximation. (auth)

6138

ON THE SCATTERING OF K^+-MESONS BY NUCLEONS IN PERTURBATION THEORY. C. Goelin and L. Taffara. Nuovo cimento (10) 5, 435-47(1957) Feb.

Using the method of Feynman and considering both the Λ and Σ particles as intermediate states, the differential and total cross sections for the scattering of scalar and pseudoscalar K^+ mesons by nucleons have been calculated in the second order approximation of perturbation theory. As a result, the various values are given which may be assumed by the ratios: R = process with charge exchange/ process without charge exchange and $R' = \sigma(K+N)/\sigma(k+P)$, as a function of the ratio $s = g^2_\Lambda / g^2_\Sigma$ of the interaction constants for the reactions $N \rightarrow K + \Lambda$ and $N \rightarrow K + \Sigma$. These results are then discussed in relation to the few experimental data so far available. (auth)

6139

K^+ NUCLEI INTERACTIONS ACCORDING TO THE OPTICAL MODEL. G. Costa and G. Patergnani. Nuovo cimento (10) 5, 448-60(1957) Feb.

The optical model has been applied to the scattering of K^+ mesons by nuclei. The nuclear potential V_n was determined following two different procedures: the first consists in the calculation of the elastic K^+-nucleus cross sections as functions of V_n; the second connects V_n with the total inelastic K^+-nucleus cross section through the elementary K^+-nucleon interaction, described by means of a Yukawa potential. The results obtained in the two cases are very similar. (auth)

6140

THE RANGE IN G5 NUCLEAR EMULSION OF PROTONS WITH ENERGIES 87, 118, AND 146 MEV. M. W. Friedlander, D. Keefe, and M. G. K. Menon (Univ. of Bristol, Eng.). Nuovo cimento (10) 5, 461-72(1957) Feb.

A comparison was made between the ranges of artificially accelerated protons in Al and in Ilford G5 photographic emulsion. The ranges in emulsion were obtained by direct measurements along the particle tracks, and those in Al by an attenuation method. The ranges of protons of three different energies were 19.31, 13.23 and 7.82 g/cm^2 in Al, and 22.85, 15.58 and 9.50 g/cm^2 in emulsion of density 3.791 g/cm^3 conditioned to 58% relative humidity. The cor-

responding energies were 146.5 Mev, 117.9 Mev and 87.4 Mev. Assuming the range-energy relation for protons to be at present better determined for Al than for photographic emulsion, this experiment provides new information concerning the relation between particle range and energy in nuclear emulsion. (auth)

6141

ANOMALOUS INELASTIC SCATTERING OF 23-Mev PROTONS BY HEAVY ELEMENTS. Bernard L. Cohen (Oak Ridge National Lab., Tenn.). Phys. Rev. 105, 1549-55(1957) March 1.

Measurements of energy distributions from inelastic scattering of 23-Mev protons by heavy elements indicate the presence of very strong, apparently monoenergetic groups. The energies, cross sections, and angular distributions of these proton groups vary slowly and regularly with atomic number. For Z>40, there is little difference between even and odd elements, or across closed shells; this complicates any explanation of these levels by single-particle excitation, and this and other factors make collective-motion explanations difficult. (auth)

6142

RANGE OF 6- TO 18-Mev PROTONS IN Be, Al, Cu, Ag, AND Au. H. Bichsel, R. F. Mozley, and W. A. Aron (Princeton Univ., N. J.). Phys. Rev. 105, 1788-95(1957) Mar. 15.

An experimental study has been made of the range and straggling of protons of 6 to 18 Mev in Be, Al, Cu, Ag, and Au. The following values of I have been obtained: Be: 63.4 ev, Al: 166.4 ev, Cu: 375.6 ev, Ag: 585 ev, and Au: 1037 ev. New range-energy curves are computed using these data and the low-energy data summarized by Allison and Warshaw. The mean straggling is evaluated to approximately 5%. In magnitude it is in agreement with theory but there is a lack of symmetry above and below the 50% point which remains unexplained. (auth)

6143

n-d SCATTERING AT 2.45 AND 3.27 Mev. John D. Segrave and Lawrence Cranberg (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 105, 1816-20(1957) Mar. 15.

Complete angular distributions for the elastic scattering of neutrons by deuterons have been obtained at 2.45 and 3.27 Mev by direct observation of the scattered neutrons using a time-of-flight technique, and results are given with a probable error of less than 3%. No support is found for the strong forward scattering indicated by a previous cloud-chamber experiment. The theoretical predictions of Buckingham, Hubbard, and Massey are in closer agreement with this experiment than are those of Christian and Gammel. n-d scattering is found to be very similar to p-d scattering at the same incident energy. (auth)

6144

LOW-ENERGY NEUTRON SCATTERING BY A SPHEROIDAL COMPLEX POTENTIAL. B. Margolis and E. S. Troubetzkoy (Columbia Univ., New York). Phys. Rev. 106, 105-9(1957) Apr. 1.

The scattering and absorption of low-energy neutrons ($kR \ll 1$) by complex square well potentials of spheroidal shape $r = R(1 + aP_2)$ is calculated by expanding the neutron wave function in terms of appropriate spherical Bessel and Neumann functions times spherical harmonics. The convergence of the results obtained is demonstrated. The "strength function" $\overline{\Gamma_n^0}/D$, the average value of neutron width to spacing, is of particular interest in nuclear physics. It can be calculated from the scattering amplitude. This strength function is plotted as a function of atomic number in the region A >90. The results are seen to deviate considerably from the corresponding results for spherical nuclei. Comparison is made with experiment. (auth)

6145

ENERGY LEVELS IN F^{18} FROM THE $O^{17}(p,\alpha)N^{14}$ REACTION. Katarina Ahnlund (California Inst. of Tech., Pasadena). Phys. Rev. 106, 124-6(1957) Apr. 1.

A separated isotopic target of O^{17} has been used to study the excitation function of ground-state alpha particles from the reaction $O^{17}(p,\alpha)N^{14}$ for proton energies between 1 and 3 Mev. Thirteen levels in F^{18} have been found, with excitation energies 6.666, 6.820, 7.304, 7.527, 7.552, 7.713, 7.728, 7.889, 7.917, 8.094, 8.216, 8.238, and 8.382 Mev. (auth)

6146

OPTICAL-MODEL ANALYSIS OF THE ELASTIC SCATTERING OF ALPHA PARTICLES. G. Igo and R. M. Thaler (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 106, 126-33 (1957) Apr. 1.

The elastic scattering of 22- and 40-Mev alpha particles on a variety of elements has been analyzed in terms of an optical model. The nuclear optical model potential assumed in this work has the form: $(V_R + iV_I)/\{1 + \exp[(r-r_1)/d]\}$. The diffuse character of the electrical charge distribution in nuclei was also taken into account. The four parameters in the nuclear optical model potential were varied so as to obtain the best fit to the data. The diffuseness parameter is found to be $d \approx 0.5 \times 10^{-13}$ cm and the parameter r_1, which represents an "average" radius of the nucleus-alpha particle system, is found to be $r_1 \approx (1.35A^{\frac{1}{3}} + 1.3) \times 10^{-13}$ cm. The average values of V_R and V_I are -45 Mev and -10 Mev, respectively, at 40 Mev. Exceptions to this are the lightest elements, C, Al, and Ti, which require -30 Mev for V_R. At 22 Mev, V_R is found to be -31 Mev. Other parameters have the same values obtained at 40 Mev. (auth)

6147

MEANING OF THE SOLUTIONS OF LOW'S SCATTERING EQUATION. F. J. Dyson (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 106, 157-9(1957) Apr. 1.

The meaning of the "redundant" solutions of Low's scattering equation is clarified, by constructing a model in which every one of these solutions may be the physically correct one. (auth)

Refer also to abstract 5988.

RADIATION EFFECTS

6148 AD-91458

Admiral Corp., Chicago.

THE EFFECTS OF NUCLEAR RADIATION ON ELECTRONIC COMPONENTS. PHASE I. Scientific Report No. 3. R. D. Shelton, ed. Apr. 1, 1956. 141p. Contract AF33(616)-3091.

A number of electronic components were irradiated in the CP-5 reactor of Argonne National Laboratory. The test group of 18 components was divided into 3 sub-groups; 6 components constituted a control group, 6 were irradiated without operation, and 6 were operated and tested during the irradiation. All components were given pre-irradiation tests, and extensive post-irradiation tests, including environmental testing, are planned for all components irradiated. The components were irradiated from 10 to 24 days at a temperature of 50°C. The total exposure varied with the location of the component in the reactor, but typical integrated fluxes were 10^{18} thermal neutrons/cm^2, 10^{18} gammas/cm^2, and 2×10^{15} fast neutrons/cm^2. The components tested included carbon composition and deposited carbon-film resistors, Ge and Si crystal rectifiers, high vacuum power and high voltage rectifiers, gaseous type power rectifiers, miniature and general-purpose triodes, cathode ray oscilloscope tubes, and mica and ceramic capacitors. For the purpose of planning

future experiments with camera tubes, material tests of various camera tube parts were performed. The RC type, carbon composition resistors underwent slight decreases in resistance. At initial reactor power increase, the resistance readings showed a distinct decrease and at an integrated thermal flux of 1.01×10^{18} there is no evidence of failure in any of the resistors. At the end of the test, the resistance values varied from a plus 1 to a minus 10% change. RF type, deposited-carbon resistors underwent an early decrease in resistance but recovered and stabilized near the initial value. There were no failures in this group. The 1N58 Ge rectifiers suffered drastic changes in backward and forward current characteristics before reaching an integrated thermal flux of 10^{18} neutrons/cm^2. The Si rectifiers showed similar variations. All 6 of the 5R4WGB power rectifiers tested showed over a tenfold apparent increase in emission current before 1.6×10^{17} NVT was reached. The tubes burned out when the normal voltage associated with the standard test circuit was applied. All the 1Z2 high voltage rectifiers operated throughout the test period without showing serious deviations. Of the 6 0Z4 power gaseous rectifiers tested in the reactor, one operated for the entire test and the remaining five either failed or showed erratic operation. All 6 of the 6C4 miniature triodes operated satisfactorily to 7×10^{17} NVT, but three of the six failed before 10^{18} NVT by interelement short circuit. The 6 3-in. cathode ray oscilloscope tubes operated throughout the test with negligible change in cathode current. Post-irradiation inspection will permit an evaluation of damage to phosphor and glass face plates. (auth)

6149 D2-1662

Boeing Airplane Co., Seattle.

GAMMA IRRADIATION OF STAR-TRACKER COMPONENTS. J. A. Barton and H. L. Steele. Jan. 11, 1957. 49p.

To determine the effects of radiation on the operation of a star-tracking system, the components of the system were subjected to gamma radiation in a Co^{60} facility. The components were both optical and electronic. Tests were performed on these components and the radiation-induced changes noted. Among the system components were crown and flint glass, silica, mirror surface, telescope assembly, photomultiplier tube, capacitor and a voltage regulator. Transmission, luminescence, and reflectance tests were conducted on the optical components, and capacitance and conductivity tests on electrical components. (D.E.B.)

6150 WADC-TR-56-557(Pt. 1)

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

EFFECTS OF GAMMA RADIATION ON AIRCRAFT TRANSPARENT MATERIALS. [Period covered] December 1955 to October 1956. Donald L. Schmidt and Robert H. Johnson. Nov. 24, 1956. 29p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task title: TRANSPARENT MATERIALS. (AD-118111).

The effects of gamma radiation on various optical, mechanical, and thermal properties of transparent plastic materials were investigated. Gafite, Plexiglas 55 and Sierracin 611 materials were irradiated in a gamma facility to total absorbed doses of 10^8 to 10^{10} ergs per gram and then evaluated in accordance with standard testing procedures. The physical properties of the transparent plastics were not significantly affected by a radiation exposure of 10^7 ergs per gram, or less. At higher absorbed doses, most of the physical properties were degraded. In addition, several desirable changes in specific physical properties were also obtained. The optical properties of the transparent plastic materials were more susceptible to radiation-induced changes than were the mechanical or thermal properties. (auth)

6151

ON THE EXCITATION IN THE CEREBRAL CORTEX OF DOGS EXPOSED TO IONIZING RADIATION. O. A. Bryukhanov and P. I. Lomonos. (Leningrad Central Inst. of Roentgenology and Radiology). Fiziol. Zhur. S.S.S.R. 33, 101-6(1957) Feb. (In Russian)

6152

RADIATION SICKNESS EFFECTS ON THE MORPHOLOGY OF CLOSED FRACTURE HEALING. A. N. Antipina and A. G. Zemlyanoĭ. (Leningrad Research Inst. of Traumatology and Orthopedics). Med. Radiol. 2, 70-9(1957) Jan.-Feb. (In Russian)

6153

GAMMA FACILITY FOR USE AT HIGH TEMPERATURES. E. L. Colichman, P. J. Mallon, and A. A. Jarrett (North American Aviation, Inc., Canoga Park, Calif.). Nucleonics 15, No. 4, 115-18(1957) Apr.

The design and construction of a laboratory irradiation facility containing 2,000 curies of Co^{60} in a 3 ton movable dome is presented. Relatively large volumes of chemical samples can be irradiated at temperatures up to 450°C with uniform dose-rate distributions. Radiation levels are reproducibly adjustable from 10^4 to 2.5×10^6r/hr. (W.L.H.)

6154

DETECTION OF DIRECTIONAL NEUTRON DAMAGE IN SILICON BY MEANS OF ULTRASONIC DOUBLE REFRACTION MEASUREMENTS. Rohn Truell and L. J. Teutonico (Brown Univ., Providence, R. I.) and Paul W. Levy (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 105, 1723-[illegible] (1957) Mar. 15.

The presence of oriented regions of displaced atoms (directional radiation damage) produced by a beam of approximately collimated fission neutrons in silicon single crystals has been observed by an ultrasonic double refraction method. The effects observed are anisotropic velocity or modulus changes which do not appear to be accompanied by attenuation changes. The irradiated crystal shows a very pronounced ultrasonic double refraction effect with waves propagated at right angles to the bombardment direction together with the absence of such a double refraction effect when the waves are propagated in the direction of the bombarding neutrons. Separate, independent, ultrasonic velocity measurements indicate that the irradiation has lowered the velocities perpendicular to the bombardment direction in a manner entirely consistent with the double refraction measurements. The observed velocity effects are not accompanied by detectable attenuation changes and are therefore not connected with dislocation damping phenomena. (auth)

RADIOACTIVITY

6155

DETERMINATION OF THE ENERGY AVAILABLE FOR THE β^+ DISINTEGRATION OF THE LONG LIVED ISOMER OF TECHNETIUM 95. Christiane Lévi and Lily Papineau. Compt. rend. 244, 1358-61(1957) March 4. (In French)

The threshold of $Mo^{95}(p,n)Tc^{95}$ was redetermined and found equal to 2.47 ± 0.03 Mev which corresponds to an energy available for the β^+ of Tc^{95} (60d) of 710 ± 30 kev. A threshold observed at 3.19 ± 0.03 Mev corresponds to an excited level of Tc^{95}. (tr-auth)

6156

NUCLEAR ENERGY LEVELS OF Li^8. Yu. L. Sokolov, M. M. Sulkovskaya, E. A. Al'bitskaya, and E. I. Karpushkina.

Doklady Akad. Nauk S.S.S.R. 111, 1219-22(1956) Dec. 21.

Studies were made of the interaction reactions of fast deuterons with the nuclei Li^6 and Li^7. The reaction products were recorded on the E1 Ilford plates, with the Li inserted directly into the emulsion. Plates containing nearly 2×10^{21} atoms of Li in 1 cm^3 of dry emulsion were bombarded by 17.5-Mev deuterons with all tracks stopping in the emulsion. The following Li^6 and Li^7 reactions were well identified: $Li^6(d,2d)\ He^4$; $Li^6(d,d',p,n)\ He^4$; $Li^7(d,t,d')He^4$; $Li^7(d,t,p,n)\ He^4$. (R.V.J.)

6157

ELECTRON-CAPTURE DECAY OF Am^{239} AND Am^{240}. W. G. Smith, W. M. Gibson, and J. M. Hollander (Univ. of California, Berkeley). Phys. Rev. 105, 1514-17(1957) March 1.

The conversion electron spectra arising from electron-capture decay of Am^{239} and Am^{240} have been studied with a 180° photographic spectrograph at ~0.1% resolution. The Am^{239} spectrum and the multipolarity data obtained therefrom are similar to those observed from the beta decay of Np^{239}, but the electron intensity data indicate somewhat different relative populations of the Pu^{239} excited states in the two cases. An attempt to assign the spin and parity of Am^{239} from ft values by the use of ΔI and ΔK selection rules does not give a consistent explanation. The energies of the first two excited states of Pu^{240} are accurately measured, and from these values (42.87 ± 0.04 and 141.77 ± 0.2 kev) the constants in the Bohr-Mottelson two-term rotational formula are evaluated: A = 7.16 ± 0.01 kev, B = 0.005 ± 0.002 kev. (auth)

6158

DECAY PROPERTIES OF 74-SECOND Ag^{111m}. Ulrich L. Schinedewolf, John W. Winchester, and Charles D. Coryell (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 105, 1763-5(1957) Mar. 15.

Silver activities were separated by a rapid elution with concentrated HCl from an anion-exchange column containing 22.5-min Pd^{111} as $PdCl_6^=$ from deuteron-bombarded Pd^{110}. The decay of Ag^{111m} was observed with a half life of 74 ± 3 sec, and its radiations were compared by aluminum absorption with those of 40-sec Ag^{109m}. Conversion electrons and x rays are seen, with less than 0.1% β decay to Cd^{111}. A search for 49-min Cd^{111m} showed less than 0.01% β decay to this species. Essentially all of the decay of Pd^{111} goes to Ag^{111m}. (auth)

6159

RADIOACTIVITY OF Ti^{44}. J. R. Huizenga and J. Wing (Argonne National Lab., Lemont, Ill.). Phys. Rev. 106, 90-2(1957) Apr. 1.

Ti^{44} has been produced by the $Sc^{45}(d,3n)Ti^{44}$ reaction. The radiations of Ti^{44} were studied with gamma-scintillation spectrometers alone and in coincidence. A decay scheme is suggested in which Ti^{44} electron captures predominantly to a 144-kev level in Sc^{44} which in turn de-excites by two gamma rays in cascade. A Ti^{44} half life of approximately 10^3 years is deduced. (auth)

SHIELDING

6160 IDO-16066

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

SHIELDING REQUIREMENTS FOR SHIPMENT OF METALLURGICAL SAMPLES. See H. Boyer. Feb. 12, 1953. Decl. July 27, 1956. 24p. Contract AT(10-1)-205. $0.25(OTS).

It is planned that tensile and corrosion samples will be irradiated for long periods in lattice position 43 of the MTR. Upon removal, the samples are to be shipped in a carrier to testing laboratories. It is recommended that a lead-shielded carrier be provided that has a minimum lead thickness of 6 in. for the side walls, 6 in. for the top, and 5 in. for the bottom. The inside container space should have a minimum diameter of $1\frac{1}{2}$ in. and a height of $9\frac{3}{4}$ in. This carrier will provide space and shielding for the shipment of two samples. An "exception" permit must be obtained for the shipment of these samples which have a much greater activity than 2.7 curies normally allowed by the Interstate Commerce Commission (ICC). (auth)

6161 NARF-57-9T

Convair, Fort Worth, Tex.

ANALYSIS OF LEAD SHADOW SHIELD EXPERIMENT. R. L. Kloster. Feb. 27, 1957. 53p. Project 6(1-9964). Contract AF33(600)-32054. (FZK-9-113).

Gamma dose rates behind lead shadow shields in water were calculated and compared with experimental measurements. The Ground Test Reactor served as the source for these measurements. The results are shown as functions of three variables: source-shield separation distance, shield thickness, and source-detector separation distance. The dose rates are analyzed in relation to the geometrical arrangement of the lead shield, detector, and source. Interrelationships of the dose rate components (primary source gammas, water-capture gammas, lead capture gammas, and gammas scattered around the shadow shield) are discussed. The analysis showed that primary and water-capture gamma rays are the important contributors to the total dose rates for most realistic shadow shield designs. However, under certain circumstances, lead capture and scattering around the shield become important. (auth)

SPECTROSCOPY

6162 AERE-NP/R-1666

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE PRODUCTION OF VERY SHORT PULSES OF PROTONS. C. Delaney. Mar. 1955. Decl. Dec. 4, 1956. 11p.

The possibility of obtaining intense proton pulses of about 10^{-8} sec duration has been investigated with a view to making a pulsed deuteron and hence pulsed neutron source. Pulses were first produced by chopping a steady proton beam. The protons were then velocity modulated and allowed to drift down a field free tube, in which bunching took place. Purely kinematical considerations showed that pulses of the order of 1/100 μsec could be produced from initial pulses of $\frac{1}{2}$ μsec, but experimentally only one quarter of the predicted bunching was achieved due to space charge effects. The mathematics of this 'debunching' are difficult, but an approximate method of calculation gave results in fair agreement with experiment. It would appear that for initial pulse currents in the ma range, debunching will make the method of little practical importance. (auth)

6163 AEC-tr-2870

CORRECTION FOR BACKGROUND IN MEASUREMENTS OF INTENSITY RATIOS. M. Honerjager-Sohm and H. Kaiser. Translated by D. E. Cardamone from Spectrochim. Acta 2, 396-416(1944). 23p.

The several methods for calculating the background consideration when calculating the intensity ratio of a spectral line are examined. It is concluded that the influence of background may be ignored and that the method of extending the density curve of the photographic emulsion is satisfactory. (T.R.H.)

6164

INFRARED SPECTRA OF THE ALKALI HALIDES. I. LITHIUM HALIDES. William Klemperer and Stuart A.

Rice (Harvard Univ., Cambridge, Mass.). J. Chem. Phys. 26, 618-24(1957) March.

The infrared spectra of LiI, LiBr, and LiCl in the gas phase have been measured in the region of the fundamental vibration frequency. The vibrational frequencies are calculated from the observed spectra to be: LiI $\omega_e = 501$ cm^{-1}; LiBr $\omega_e = 576$ cm^{-1}; LiCl $\omega_e = 662$ cm^{-1}. There is no evidence in the spectra for the existence of appreciable quantities of dimeric molecules, the estimated dimer concentration being thus restricted to less than 15%. The apparatus used appears suitable for absorption measurements above 2000°C. (auth)

6165

ELECTRON PROBE MICROANALYZER AND ITS APPLICATION TO FERROUS METALLURGY. R. Castaing, J. Philibert, and C. Crussard. J. of Metals 9, 389-94 (1957) Apr.

An apparatus using the properties of x radiation, emitted by substances under electron bombardment, as a means of rapid chemical point analysis is described. The method is based upon the principles of emission x-ray spectrography and is useful in studying the interdiffusion between two metals or alloys at high temperatures. (auth)

6166

VIBRATIONAL ANALYSIS OF THE MOLECULAR SPECTRA OF POLONIUM. G. W. Charles (Oak Ridge National Lab., Tenn.) and D. L. Timma, D. J. Hunt, and G. Pish (Mound Lab., Miamisburg, Ohio). J. Opt. Soc. Amer. 47, 291-6(1957) Apr.

Measurement of spectrograms of electrodeless discharges in purified Po has yielded over 450 red-shaded band heads in Po^{210} and more than 500 heads in mixtures of $Po^{208}-Po^{209}$. Approximately 350 of these have been classified in a system concluded to be the principal system of Po–Po with the following constants ($Po^{210}-Po^{210}$): $T_e' = 25149.3$ K, $\omega_e' = 108.532$ K, $\omega_e'x_e' = -0.4417$ K, $\omega_e'' = 155.715$ K, $\omega_e''x_e'' = -0.3353$ K, $\omega_e''y_e'' = -0.0003226$ K. Observed and calculated isotope shifts are in close agreement. The dissociation energy of the lower state is calculated to be 1.895 v under the assumption that the dissociation products are normal polonium atoms. (auth)

6167

ISOTOPE SHIFT IN THE SPECTRUM OF MERCURY. Fred McClung and John R. Holmes (Univ. of Southern California, Los Angeles). J. Opt. Soc. Amer. 47, 297-9 (1957) Apr.

By using separated isotopes of Hg^{198} and Hg^{202} in sealed discharge tubes, the isotope shift in several lines from 16,000 A to 4000 A has been measured with direct recording techniques. A grating crossed with a pressure tuned Fabry-Perot interferometer was coupled to electronic detectors to make a linear recording system. The detectors were a photomultiplier tube in the visible and a lead sulfide cell in the infrared. The output of the detector is amplified and then recorded on a strip chart recorder. By optical switching between the two discharge tubes during the recording both isotopes appear on the same record without overlapping of the intensity pattern. Because of the inherently high accuracy of this type of system the probable errors are small. (auth)

THEORETICAL PHYSICS

6168 OSR-TN-57-132

Pennsylvania. Univ., Philadelphia.

COMPLETE SET OF DISPERSION RELATIONS FOR A CLASS OF FIXED SOURCE MESON THEORIES. Technical Note No. 6. Richard E. Norton and Abraham Klein. Mar. 1957. 45p. Contract AF18(603)-60. (AD-120488).

The structure of the transition matrices for all processes that can occur for a class of fixed source meson theories is studied. The model consists of scalar meson field coupled to an extended source in such a way that any finite number of quanta can be emitted or absorbed at a given time (multiple vertices), but that all interactions are restricted to be S-wave in nature. The general reaction matrix element for m incident and n emergent particles contains many terms describing sequences of independent processes, which must be removed before one obtains a proper object for studies of a dispersion theoretic nature. It is shown that the ratio of the residual matrix element to a suitable product of source functions possesses those analytic properties, as a function of the total energy of the system, which permit dispersion relations to be stated. Other than for the elastic scattering amplitude the latter make reference to values of the amplitude in a nonphysical energy region. In conjunction with a suitably generalized unitarity condition, however, the scheme, when viewed as a set of coupled integral equations, can be solved by successive approximations in terms of a number of arbitrary constants, essentially equal to the number of coupling constants in the original Hamiltonian (actually one fewer). Nevertheless, it is pointed out that the scheme does not admit a unique solution, and this is illustrated physically by exhibiting an extended class of Hamiltonians which yield the same dispersion relations, but which, as a class, contain more coupling constants than make their appearance in the dispersion relations. Physically, these are connected with the occurrence of resonance scattering. (auth)

6169 OSR-TN-57-133

Pennsylvania. Univ., Philadelphia.

THE MANY BODY PROBLEM IN QUANTUM FIELD THEORY. Technical Note No. 7. Abraham Klein and Charles Zemach. Mar. 1957. 38p. Contract AF18(603)-60. (AD-120489).

A formalism for the covariant description of scattering processes involving composite particles is derived from first principles. Its basic ingredients are the Green's functions of quantum field theory combined with a physically sound formulation of the adiabatic hypothesis. Explicit expressions are presented for various examples of nucleon-nucleus and boson-nucleus collisions. It is shown that the impulse approximation can be formulated for such problems. A general method of obtaining electromagnetic moments of nuclei, based on the scattering formalism, is also derived. The normalization condition for covariant amplitudes is discussed and its application to bound-state problems reviewed. In particular, a method of carrying out perturbation theory for the discrete spectrum is suggested. (auth)

6170

ON THE CONDITIONS OF THE RELATIVISTIC INVARIANCE OF THE QUANTUM THEORY. Uy. M. Shirikov (Lomonosov Moscow State Univ.). Doklady Akad. Nauk. S.S.S.R. 111, 1223-6(1956) Dec. 21. (In Russian)

Investigations were made of general requirements with which any relativistic quantum theory must agree. These requirements can be fulfilled by transposition of correlations in a more general way than is required by the known conditions for quantum theory invariance. In quantum field theory these correlations cannot be performed. (R.V.J.)

6171

ON THE SIGNAL SHAPE IN ATOMIC NUCLEI MAGNETIC RESONANCE WITH MEAN TIME RELAXATION. N. M. Ievskaya (Lomonosov Moscow State Univ. Dept. of Physics). Izvest Akad. Nauk S.S.S.R. Ser. Fiz. 20, 1226-31(1956) Nov. (In Russian)

A simplified method is offered for measuring the longitudinal τ_1 and the transverse τ_2 relaxation time. The values τ_1 and τ_2 obtained for various concentrations of copper sulfate- and ferrous sulfate–water systems coincided with the published data. However, the method is simpler and can be used for measuring the relaxation time in a nonstabilized constant magnetic field. (R.V.J.)

6172

REMARKS ON THE FIXED EXTENDED SOURCE PION THEORY. H. Fukutome and Y. Nogami (Kyoto Univ., Japan and Univ. of Osaka Prefecture, Sakai, Japan). Nuovo cimento (10) 5, 347-55(1957) Feb.

Cini and Fubini's analysis on the possibility whether the fixed extended source pion theory can reproduce the low energy experimental p-wave pion-nucleon scattering cross sections is reinvestigated in the light of the restrictions: (i) The requirement that the probability can not be negative imposes some restrictions on the expectation values of the operators τ_α, σ_i and $\tau_\alpha \sigma_i$, and (ii) there is a geometrical limitation on the scattering cross-section. It becomes clear that, as far as the contribution to Cini and Fubini's sum rules from the high energy region (above cut off) is small, the theory can not reproduce the experimental scattering cross sections, even for the low energy region (pion kinetic energy $\lesssim$ 300 Mev). However, there is no reason to consider that the high energy contribution be small. On the other hand, it is almost certain that the theory can reproduce the experimental p-wave pion nucleon scattering cross section for the low energy region. This implies that the high energy contribution to Cini and Fubini's sum rules is important and should not be neglected. (auth)

6173

STUDY OF THE NUMBER OF VIRTUAL MESONS BY A SIMPLE MODEL. E. Arnous. Nuovo cimento (10) 5, 483-90(1957) Feb. (In French)

A well-known model is studied, where the nucleons are considered as fixed and extended sources interacting with a neutral scalar field. The exact wave function of the ground state is computed, and it is shown that the probability distribution of the number of virtual mesons is a Poisson distribution. The mean value of that number is computed as a function of the radius of the sources and of the distance between the nucleons. It is seen that his number of virtual mesons never exceeds one or two, for radii and distances of the order of 10^{-13} cm and values of $g^2/4\pi\hbar c$ of the order one. The above results seem to justify methods of the Tamm-Dancoff type. (auth)

6174

STRONG COUPLING. A. Pais (Inst. for Advanced Study, Princeton, N. J.) and R. Serber (Columbia Univ., New York). Phys. Rev. 105, 1636-52(1957) March 1.

For the case of the charged scalar theory a class of rigorous transformations is described which brings into explicit evidence the dependence of the Hamiltonian on the charge of the system. These transformations are noncanonical, nonadiabatic, and nonlinear. The strong-coupling Hamiltonian is obtained as a special case and is given in closed form. It is shown that in static approximation there exist bound states for arbitrarily high value of the charge of the isobar. The validity of the expansion method dealing with nonstatic effects is discussed, and it is shown that the usual strong-coupled procedure at best has meaning only for finite source size. The definition of nucleon-one meson states in the presence of finite isobar level separations is treated. (auth)

6175

SELF-CONSISTENT TREATMENT OF THE INDEPENDENT-PARTICLE CENTRAL-FIELD NUCLEAR MODEL. G. E. Tauber (Western Reserve Univ., Cleveland) and Ta-You Wu (National Research Council, Ottawa, Can.). Phys. Rev. 105, 1772-83(1957) Mar. 15.

The purpose of the present work is, starting from a given assumed nucleon-nucleon interaction $V(r_i - r_j)$ and the independent-particle, central-field approximation, to deduce all the consequences of this model by means of the Hartree-Fock-Slater theory. The $V(r_i - r_j)$ is chosen to satisfy the saturation requirement and to be consistent with some of the properties of the two-nucleon system, but contains the strength factor V_0 as an undetermined parameter. This V_0 and the single-particle wave functions $\psi_n(r_i)$ are determined by the variational principle together with the requirement that the total binding energy of the nucleus be equal to its empirical value. The binding energies of the individual nucleons in the various shells are themselves approximately given by the Fock equations which also lead to a central field which is different for the different shells. The average central field implied in the usual treatment of the shell model is, however, the same for a nucleon in any shell, and this must be identified with some approximate average field obtained by a procedure such as that suggested by Slater for an electron in an atom or in a metal. On the other hand, the central field in the sense of Hartree (i.e., obtained from the Fock theory by neglecting the exchange terms) would be a very poor approximation as the exchange terms are not negligible compared with the direct terms. It is emphasized in the present work that the application of the variational principle to the problem rids the shell model of the inconsistent procedure in the usual treatments in which two independent assumptions concerning $V(r_i - r_j)$ and the average central field $V(r)$ are made. A comparison of the result of the present program with the empirical facts will form a correct basis on which to judge the fairness or failure of the central-field approximation in the shell model. Numerical calculations have been carried out for the O^{16}, O^{15}, and O^{17} nuclei to illustrate the ideas of the self-consistent treatment of the independent-particle, central-field nuclear model. In a first approximation, the V_0 and the wave functions $\psi_n(r_i)$ are determined by the modified Ritz method. The binding energies and the effective "central fields" for the individual nucleons in the various shells are then calculated from the Fock equations by means of these $\psi_n(r_i)$. It is found that the parameter V_0 in O^{16}, O^{17}, and O^{15} comes out to be very nearly the same, that the Fock central potentials are considerably lower than the Hartree potentials; that the former exhibit a general shape of a wine-bottle with a diffuse boundary; and that the "binding energy of the last nucleon" does not come out very well from the Fock equations. (auth)

6176

ELECTRON EFFECTS ON BARRIER PENETRATION. Victor A. Erma (Naval Ordnance Lab., White Oak, Md.). Phys. Rev. 105, 1784-7(1957) Mar. 15.

The effect of the surrounding electrons on the nuclear barrier penetration probability is considered. The nuclear potential is replaced by the Fermi-Thomas potential for heavy atoms, and by a potential derived from a constant electron-density model for very light atoms. The theory is applied to the evaluation of alpha decay periods and of the rates of thermonuclear reactions including the d-d reaction. It is shown that to first order the electron effect can be considered as an increase in the "effective energy" of the alpha particle. Numerical computations were made for the cases of the alpha decay of Rn^{222}, Po^{212}, Sm^{147}, and for the rates of the d-d and the $p + N^{14}$ reactions. (auth)

6177

PARTICLE ASPECT OF THE ELECTROMAGNETIC FIELD EQUATIONS. R. H. Good, Jr. (Pennsylvania State Univ., University Park). Phys. Rev. 105, 1914-19(1957) Mar. 15.

It is shown that Maxwell's theory of the electromagnetic

field in vacuum can be stated in a form closely parallel to Dirac's theory of the electron. The electromagnetic field is described by a three-by-one column matrix whose elements are linear combinations of the three independent spinor components of the field. The Maxwell equations take a form similar to the Dirac equation for a free electron but involving three-by-three matrices. In terms of a wave function normalized so that the integral-square is the number of photons, the classical expressions for the energy, momentum, and angular momentum in the field are related to expected values of the Hamiltonian, momentum, and angular momentum operators. The angular momentum operator consists of an orbital part plus a three-by-three spin-one matrix part. As in Dirac's theory, the contributions from the states of negative Hamiltonian eigenvalue must be subtracted—these are states of opposite circular polarization. (auth)

6178

COMMUTATION RELATIONS OF INTERACTING SPINOR FIELDS. Richard Spitzer (Univ. of California, Berkeley). Phys. Rev. 105, 1919-23(1957) Mar. 15.

It is shown that the requirement that the Hamiltonian density commute with itself on a spacelike surface precludes the possibility that three or more different spinor fields, coupled to one another in Yukawa-type interactions, commute with each other. If the Hamiltonian contains only two such fields, however, they may be assumed either to commute or to anticommute without violating this requirement. (auth)

6179

VELOCITY-DEPENDENT FORCES AND NUCLEAR STRUCTURE. I. CENTRAL FORCES. Marcos Moshinsky. Phys. Rev. 106, 117-23(1957) Apr. 1.

Starting with the assumption that the forces between nucleons inside nuclear matter are the same as between free nucleons, a procedure is outlined by which information on the velocity dependence, and other features, in the two-nucleon interaction may be obtained from the level ordering in nuclear shell theory. Discussions are restricted to the simplest type of velocity-dependent central force, which turns out to be similar to the reduced-mass type of force introduced for the motion in nuclear matter by Brueckner and by Johnson and Teller. If this force is taken with a sign such that the reduced mass is smaller than the mass of the nucleon, it behaves in the long-range approximation as a repulsive Majorana force. In the short-range approximation, the level ordering for the two-particle configuration goes in order of increasing J in the $p_{\frac{3}{2}}$ shell, in the order J = 4, 0, 2 in the $d_{\frac{5}{2}}$ shell, and in order of decreasing J in all other shells. For a three-particle configuration the ordering goes as $J = \frac{9}{2}, \frac{5}{2}, \frac{3}{2}$ in the $d_{\frac{5}{2}}$ shell and as $J = \frac{9}{2}, \frac{3}{2}, \frac{5}{2}$ in the $f_{\frac{7}{2}}$ shell. This ordering is compared with the experimental one, and restrictions on the strength and range of the velocity-dependent force that may be added to the ordinary one are obtained. (auth)

6180

METHOD OF FUNCTIONALS IN QUANTUM FIELD THEORY. Yu. V. Novozhilov and A. V. Tulub. Uspekhi Fiz. Nauk 61, 53-102(1957) Jan. (In Russian)

Detailed studies were made of the method of functionals in quantum field theory and of production functionals for nonrelativistic functions. The problems of production functionals for relativistic functions, functions in space-time analysis, and the functional integrations on the Fermi field were also investigated. (R.V.J.)

6181

CONFERENCE ON PHYSICS OF HIGH-ENERGY PARTICLES. Uspekhi Fiz. Nauk S.S.S.R. 61, 103-28(1957) Jan. (In Russian)

Reports were presented by the native and foreign specialists on the subject of meson formations by nucleons and on the problems connected with the theory and construction of elementary particle accelerators of various types. Accelerators, linear accelerators, installations with strong focusing, and methods of experiments with high-energy particles were discussed. The conference was held in Moscow, May 14 to 22, 1956. (R.V.J.)

URANIUM AND URANIUM COMPOUNDS

6182

ZONE MELTING OF URANIUM. C. I. Whitman, V. Compton, and R. B. Holden (Sylvania Electric Products Inc., Bayside, N. Y.). J. Electrochem Soc. 104, 240-4 (1957) April.

A study was made of the possible application of the zone melting technique to the separation of uranium from fission products and other impurities. Bar specimens of U having various alloying elements were zone purified in thoria-coated alumina boats. Uranium bars previously irradiated in the Brookhaven pile were also zone melted. Zone melting has potential application in the removal of such impurities as B, Fe, Si, Ni, and Co from ordinary U. In the reprocessing of irradiated U, zone melting offers a method for removing such fission products as Zr, Nb, Ru. However, as employed here, it shows little promise as a method for complete decontamination of irradiated U from fission products, primarily because of concurrent slagging effects. (auth)

6183

ON THE DEPENDENCE UPON ENERGY OF THE FISSION PRODUCT POISONING OF U^{235}. U. L. Businaro, S. Gallone, and D. Morgan. J. Nuclear Energy 4, 319-25 (1957) Mar.

A calculation is made of the energy dependence of the average cross section of the fission products of U^{235}. Two methods are used. One is based on the average over many resonances of cross sections and uses low-energy data on average widths and spacings: the other applies the "continum theory" formulae normalized on experimental cross sections at 1 Mev. (auth)

6184

LOW-LYING LEVELS IN U^{238} EXCITED BY INELASTIC NEUTRON SCATTERING. Robert C. Allen (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 105, 1796-8(1957) Mar. 15.

Analysis of neutrons inelastically scattered by U^{238} indicates that the first two excited states in U^{238} are at 50 ± 20 kev and 140 ± 25 kev. The inelastic collision cross sections, the total inelastic scattering cross sections, and the partial inelastic scattering cross sections for the excitation of these levels are presented for neutron energies of 150, 250, and 500 kev. (auth)